DIABETES HEALTH PROMOTION SELF-CARE AND CLINICAL OUTCOMES AMONG PATIENTS WITH TYPE 2 DIABETES IN CHI-DU DISTRICT, KEELUNG, TAIWAN

by

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Abstract

Diabetes has become a major public health concern worldwide. The prevalence and mortality rates of diabetes in Taiwan are increasing annually. Keelung ranks higher for incidence of diabetes than the nationwide average of Taiwan. Inadequate monitoring of diabetes leads to dialysis, amputation, heart disease, stroke, retinopathy, vascular disease, depression, and other complications, all of which affect individuals, their families, and societies. Although chronic diseases are rarely cured, they can be managed through individuals and their family members' efforts, resilience, diligence, and embrace of facilitating beliefs. However, according to the National Health Insurance program of improved care for diabetes, only 30% of patients with diabetes have been able to maintain HbA1c at 7%, a top-down medical model of diabetes care that is irrelevant for 70% of patients. To control diabetes more appropriately, it is necessary to not only focus on medical science, diet, fitness, oral medication, and insulin, but also needs to place a strong emphasis on considering the experiences of patients' family members. Cultural and societal beliefs may influence how people manage illness. Therefore, identifying a locally appropriate method to link vertical and horizontal approaches in a manner that is equitable, which engages communities as partners, and promotes community empowerment by linking the top-down and bottom-up models through community health workers could potentially reduce expenditure on medical health insurance. Moreover, this approach could be applied to improve diabetes control and achieve an integrated health care program. A cross-sectional study was conducted to compare the effectiveness of a multidisciplinary, community resources-based, integrated primary- secondary care diabetes service (Sweet Family) with that of the usual care provided at a community clinic at Chi-Du District, Keelung City in Taiwan. The study provides empirical evidence concerning the impact of primary care on Type 2 diabetes patients' health outcomes, thereby assisting clinicians to deliver more sensitive clinical care.

Key words: type 2 diabetes, community-based screening, sweet family

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Taiwan has a high standard of health insurance system, thanks to the valuable life experience provided by all diabetic patients participating in this study. Otherwise, Thanks Ching Kuo Institute of Management and Health designed physical exercises for the elderly and family physician Ji's clinic integrated group leads the effort dismantle these barriers to health care through programs that target the biggest disparities are not alone in this effort, that collaborate with a wide range of dedicated community partners to improve access to health care and promote healthy living throughout Keelung community.

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Statement of the Problem

Type 2 diabetes (T2D) is a progressive condition involving beta cell failure with insulin resistance, hyperglycemia, and microvascular and cardiovascular complications, and has become a critical public health challenge in Asia, including Taiwan(Chan et al., 2009). Diabetes was the fourth or fifth leading cause of death in Taiwan each year between 1991 and 2012 (Taiwan Ministry of Health and Welfare, 2013); however, it ranks third in Keelung City. In Taiwan, three out of four patients with diabetes die because of cardiovascular disease. Furthermore, the stroke rate is 2- 4 times higher in diabetic patients than in the general population. Approximately 30% and 70% patients experience concurrent kidney and cardiovascular disease, respectively (Taiwan Bureau of National Health Insurance, 2011). Increases in the number of diabetes patients and difficulty in controlling diabetes have resulted in its being a heavy burden at the individual, family and governmental levels. Initially, different levels of medical institutions should be examined to optimize medical services. In Taiwan diabetes support groups have been established in cooperation with hospitals and public health units under the guidance of the Bureau of Health Promotion. Taiwan currently has 514 diabetes support groups (Health Promotion Administration, Ministry of Health and Welfare https://data.gov.tw/dataset/8833). Each group has a facilitator, a certified diabetes educator and a public health nurse serving as the facilitators in the hospital-and community-based groups. These facilitators invite patients with HbA1C>7% to join the support group. In addition, those patients with adequate blood sugar control who are willing to help fellow patients are invited to support the current group members. People attending these support groups are more likely to exhibit superior self-care behavior and disease control than non-attenders(Kornelius et al., 2015). However, because diabetes care primarily consists of self-management by patients in their own homes and communities, self-management must be

integrated with care provided by the health care system. The purpose of our study is to build diabetes resources across community organizations; establish routine systematic home visits or telephone follow-up diet control, maintain regular exercise, foot care and adherence to the recommended regimens; encourage interactive dialogs between families and the health care system; strengthen trust between the program and the community to promote access to care and quality of care; and finally to maximize improvements in community health. These measures in turn support community programs related to diet, fitness, and other health-related areas.

Research Objective

From 2012 to 2013, there has been a sharp increase in the prevalence of diabetes mellitus (DM) in Keelung City(Taiwan Ministry of Health and Welfare, 2016). Patients with DM have multiple requirements, including access to information about their illness and the various treatment options for preventing possible complications (e.g. eye complications, coronary heart disease and foot protection); social support; decision-making support; and assistance in practicing optimal lifestyle habits, such as changes in diet and exercise. Developing superior delivery systems for diabetes and implementing community-based monitoring of diabetes mortality could constitute a powerful "targeting mechanism." Strong training and support for community-based workers were integral to the program implemented in Chi-Du District in 2012. These workers continue to be in routine contact with diabetic patients and their families, as well as being involved in developing humanistic and healing relationships (through the Sweet Family group). This study focused on primary health care and relationship building among community members. Community involvement is a critical element for successfully solving problems within communities. Our results can provide information to facilitate further analyses of reduction of

morbidity and mortality due to chronic complications as well as the optimization of cost-effectiveness after therapy in diabetic patients. Ultimately, effective public health policies on diabetes prevention and control are essential.

The research objective was to test the hypothesis that a primary care practitioner and the Sweet Family group can provides quality diabetes care associated with a healthy life, increase DM risk awareness, and reduce adverse health care utilization. The specific study objectives are listed below.

Objective 1: To determine the effect of community-based general practice setting care on glycemic control and other clinical indicators relative to that of the usual care at a diabetes outpatient clinic.

Objective 2: To determine whether community-based general practice setting care can reduce adverse utilization, such as emergency visits and hospitalizations for diabetes.

Objective 3: To determine the perspectives and experience of DM patients and health care professionals regarding the self- management of diabetes.

Background and Literature Review

Background

Health care in Taiwan is administrated by the Ministry of Health and Welfare of the Executive Yuan (the Cabinet). Taiwan comprises approximately 23 million people with a standard of living comparable to that of many western countries. Similar to other developed economies, Taiwanese people are well-nourished; however, they face health problems, such as chronic obesity and heart disease. Life expectancies for women and men are 83.3 and 76.7 years, respectively, and the infant mortality rate was 3.7 per 1000 live births in 2013. In 2014, the leading causes of death in Taiwan were malignant neoplasma, heart disease, cerebrovascular diseases, and diabetes(Taiwan Ministry of Health and Welfare, 2016). Although approximately 12.83 % (2016) of the Taiwan's population is aged more than 65 years, the health care system is a dispersion model. People visit physicians, approximately 14.7 times annually on an average, including dental and traditional medicine visits. Taiwan has 1.6 physicians and 5.9 hospital beds per 1,000 populations. Two thirds of physicians are hospitals employees (receiving salaries or salaries plus bonuses), and the remaining are private practitioners with their own clinics. Hospitals run large outpatient departments (OPD) (Lai).

In March 1995, Taiwan established the National Health Insurance (NHI) program. A single-payer compulsory social insurance plan, NHI centralizes the disbursement of health-care funds, and is administered by the Bureau of National Health Insurance, which is controlled by the Department of Health. The program promises equal access to health care for all citizens, and population coverage had reached 99% by the end of 2004(C., 2004). NHI is mainly financed through premiums, which are based on the payroll tax, and is supplemented with out-of-pocket payments and direct government funding. The spending on health care per capita is US$ 755, accounting for approximately 6.23% of GDP in 2008 (news, 2008). All hospitals and

approximately 90% of clinics in Taiwan are contracted with NHI. The NHI program has introduced a diagnosis-related group payment system and taken the following steps to reform it. It has established a separate global budget system for dental services, Chinese medicine, primary care groups and hospital services and has piloted a quality-based payment program through which NHI is paid for treating certain diseases (breast cancer, asthma, diabetes, and tuberculosis) and for cervical cancer screening (Ian Willams). The second-generation NHI program was implemented in 2013. Its core principles are equity, efficiency and quality in order to protect the rights and interests of vulnerable groups.

Because of rapid urbanization and the successful public health improvements achieved during the past few decades, Taiwan is transitioning from being a traditional society to one with rapidly increasing numbers of middle-aged and elderly people among whom chronic disease is the dominating pattern. Although NHI has led to equal accessibility to the health care system, which is a facility-based curative and preventive service, not finding a locally appropriate method for linking vertical and horizontal approaches in a manner that is equitable, engages communities as partners, and promotes community empowerment by linking the "top-down" and "bottom-up" models may result in new challenges in quality of care and efficiency of payments. Health promotion is a major component of the primary prevention of DM complications. The study findings hope to decrease the rate of DM complications and mortality in Keelung, in response to the sharp increase in diabetes mortality rates from 24.6/100,000 in 2011 to 33.6/100,000 in 2013. The Keelung Community-based Integrated Screening program, which was initiated in Keelung on January 1, 1999, provides a screen package every year for five types of cancer (cervical, breast, oral, liver, and colorectal) and three types of chronic disease (hypertension, diabetes, and hyperlipidemia). Databases of this program are managed by a health

information management system, which supplies validation, database linkage, and referral management. Previous study findings indicate that it is necessary to enhance the quality of Keelung public health and life (C. C. Chen et al., 2008; Chiu et al., 2015). Department of Health, The Keelung City Government aims to integrate public health, professional medical organizations, community-based health care, and community resources to construct a cost-effective community health care network and thereby enhance the self-management ability of diabetic patients, as well as provide comprehensive, continual, coordinated, accessible, and responsible holistic care. In addition, community participation must be strong, because of its potential to provide well-trained and supervised help to diabetic patients. Although our understanding of the mechanisms underlying T2D has many gaps, several community health nursing strategies have been shown to be effective in combating this public health crisis (Bellary et al., 2010; Campbell, Walker, Smalls, & Egede, 2012; Dauvrin, Lorant, & d'Hoore, 2015; Kanaya et al., 2011). This study evaluated the patient outcomes of a novel integrated primary model of community care for T2D management by comparing them with those of the standard care provided at a Keelung community clinic for diabetes patients. Thus, the purpose of this study was to understand the association between diabetes care and health outcomes. The study involved examining the effectiveness of the DM support group approach (Sweet Family) in the Chi-Du community, the main objectives of which include providing high quality health care, enhancing health status and quality of life (QOL), and providing a reference that enables policy makers and clinical professionals to reduce DM complications.

Literature review

A. Significance of DM care

The number of diabetic patients in Taiwan have increased annually, in parallel with global trends in DM. Approximate increases of 70% in the total diabetic population (70.7 million in 2000, 120.5 million in 2009), 55% in the prevalence rate, and 35% in the age-standardized prevalence rate were observed in the analysis period (Jiang, Chang, Tai, Chen, & Chuang, 2012). Prevalence was categorized by age group and gender. From 2000 to 2008, the increases in the prevalence rate were 33% for women aged less than 19 years, 15% for women aged 20–39 years, 23% for women aged 40–59 years, 31% for women aged 60–79 years, and 61% for women aged 80 years and older. Moreover, for men in the same age groups, the increases were 33%, 54%, 54%, 47%, and 69%, respectively. The overall increases in prevalence from 2000 to 2008 were 56% and 74% for women and men, respectively (Chan et al., 2009).

Taiwan's NHI claims database provides healthcare services with the highest coverage rate and accessibility, and constitutes the most crucial health care records for Taiwan (23 million people). T2D has become a critical public health challenge in Asia, including Taiwan (Chan et al., 2009). Using (NHI) claims data, Chuang et al. conducted a series of studies describing the trends of prevalence, incidence, mortality, treatment patterns, comorbid diseases, and complications of DM during the past decade (Lai, 2012). Despite an increase of approximately 25% in overall diabetes incidence, the mortality of patients with diabetes in Taiwan decreased continuously from 2000 to 2009 for both sexes and all age groups; the mortality rate was generally higher for men than for women (3.92% vs. 3.29% in 2000; 3.64% vs. 3.11% in 2005, and 3.12% vs. 2.71% in 2009). When diabetes was diagnosed at

the age of 40, estimated death due to diabetes was 6.1 and 5.3 years in women and men, respectively, in 2009. Other than diabetes, the three major causes of death were malignancies, heart diseases, and cerebrovascular diseases (Li et al., 2012). Although the prevalence of patients with diabetic kidneys has increased (4.1% in 2000, and 5.45% in 2009), the prevalence rate of dialysis in diabetic patients has reached 2.46% in 2009 (over three million), eye complications reached 6.2% in 2000 and 8.91% in 2009, the blindness rate reached 0.62%, and foot disease reached 1.9% in 2000 and 2.47% in 2009. Furthermore, 1% per annum of patients were hospitalized due to diabetic foot conditions, and the number of patients with limb amputation has been declining (approximately 4,000 cases per year). The prevalence of macro-vascular disease in this decade has decreased. The prevalence of ischemic stroke in diabetic patients was 6.79%, and those of cardiovascular disease, myocardial infarction, concomitant hypertension, and hyperlipidemia were 33.4%, 2.37%, 64.5% and 46.4%, respectively. Due to increase in aging, comorbidities of diabetic patients, and the number of patients with chronic complications of diabetes, people will continue to face greater challenges in diabetes treatment. Therefore, appropriate prevention programs and the future development of new drugs and strategies are necessary (Y. Y. Huang et al., 2012; Tseng et al., 2012). In addition, the frequency of annual check-ups for various metabolic parameters and the complexity of anti-diabetic therapy have increased during the past decade, thereby improving the quality of diabetes management in Taiwan. Diabetes and end-stage renal disease (ESRD) synergistically increase the risks of cardiovascular events, 5.24 [95% confidence interval (CI) 4.83-5.68) (Y. T. Chang, Wu, Hsu, Wang, & Sung, 2014). Proactive screening and control for diabetes in patients with ESRD must become a part of daily practice (Y. T. Chang et al., 2014). Moreover, angiotensin-converting enzyme inhibitors

or angiotensin receptor blockers are widely recommended for hindering the progression of renal disease among DM patients (L. Y. Huang, Yeh, Su, Wang, & Hsieh, 2013). Furthermore, diabetes patients affected with both micro- and macro-vascular complications incurred costs 4 times higher than those without complications. The average OPD cost per diabetic patient and average inpatient department (IPD) cost at each admission for diabetic patients were 4 times and 1.4 times higher, respectively, compared with those for the general population. High-risk individuals must be screened to ensure earlier intervention, in order to reducing the possibility of diabetes complications and further healthcare expenditures (T. J. Chang et al., 2012) The results of a survey by Taiwan's diabetes promotion agencies were HbA1c < 7(21.1% in 2002, 35.4% in 2011), BP < 130/80 (23.9% in 2002, 38.7% in 2011), and lipids (LDL) < 100mg/dL (30.9% in 2002, 49.8% in 2011). These data provide a benchmark for refining health policies for preventing, screening, and treating diabetes in Taiwan (Jiang et al., 2012). Diabetes medications have exhibited a trend of diversification as new drug combinations are further studied for their efficacy in patients, as well as for the national socio-economic aspects of their impact. In addition, the trend of diabetic patients visiting hospitals for the OPDs and IPDs has increased, whereas visits to local hospitals have decreased over the past decade (T. J. Chang et al., 2012). The Taiwanese government is actively involved in health care system reform and has dealt with quality as a system property. Quality improvement activities have been increasing in Taiwan, of which many are involved in diabetic patient management. In an attempting to improve the quality of care, Taiwan has established practice guidelines for diabetic care, implemented accreditation for diabetes care institutions, and set up shared care networks in 25 counties (Lai). Glickman (2007) Pay-for-performance (P4P) has been promoted as a tool for enhancing the quality of

care among patients through financial incentives. A slightly higher rate of improvement was identified for two of six targeted therapies at P4P hospitals than at control hospitals for acute myocardial infarction using odds ratio (ORs) to compare adherence scores from 2003 to 2006 at half-year intervals for aspirin at discharge, 1.31; 95% CI, 1.18-1.46 vs OR, 1.17; 95% CI, 1.12-1.21; P=.04 and for smoking cessation counseling (OR, 1.50; 95% CI, 1.29-1.73 vs OR, 1.28; 95% CI, 1.22-1.35; P=.05) (Glickman et al., 2007). Since 2001, the Bureau of NHI has implemented a P4P program for diabetes, emphasizing a chronic care model with a multi-disciplinary care team and providing financial incentives for health care providers to increase the frequency of regular follow-up visits including enhanced self-care education and comprehensive diabetes-specific assessments. DM patients are encouraged to use their DM passports to enhance their patient self-care skills. Professional accountability, presented by the frequency of laboratory monitoring for diabetic patients, is widely accepted as an indicator of quality assessment for diabetes care in the process domain (中華民國衛生福利部, 2016). Lee (2010) reported that a diabetes P4P program (n = 12,499) was associated with a significant increase in outpatient follow-up visits and evidence-based services (3.8 vs. 6.4, $P < .001$) for enrolled patients, compared with those not enrolled (3.5 vs. 3.6, $P < .001$). The program was also associated with higher overall costs and significantly lower hospitalization costs (-0.027, $P = .003$)[27].(T. T. Lee, Cheng, Chen, & Lai, 2010) The multidisciplinary team works to provide integrated and coordinated care to patients with DM and major cancer. Patients in the intervention group incurred higher expenses because of physician visits but lower expenses because of inpatient services, with a net increase of $104 per person per year ($P <.001$). These quality measures were subsequently adopted by the Taiwan Quality Improvement Program for internal accountability comparison and were presented on the

website for transparency (T. T. Lee et al., 2010).

B. Risk factor in frailty and DM

Pariser et al. (2013) examined whether HbA1c and frailty were effectively reduced in participants of Active Steps for Diabetes, which was a self-management education program for aging adults with diabetes and frailty. It was found to increase participants' capacity for physical activity, which is integral to blood glucose control; however, achieving this was difficult for frail, older adults (Pariser, Hager, Gillette, Golemboski, & Jackson, 2014). Physical activity was a major pathophysiological metabolic syndrome factor in Asian geriatric participants (C. L. Chang et al., 2013). Litzelman (1993) examined the effects of contractions on the prevention of diabetes-associated lower extremity abnormalities (musculoskeletal and dermatological), and on the treatment of T2D (Bosch-Capblanch, Abba, Prictor, & Garner, 2007). It is necessary to develop superior delivery systems in the community, such as local household and community health-related programs. Therefore, active participation from the community, community ownership, organized control of programs, and an emphasis on building long-term partnerships are required for these effective collaborations. Ultimately, community-based workers must achieve routine contact with diabetic patients and their families, as well as provide preventive and curative primary health care services directly at their homes.

Nature has become increasingly central to social thinking. From the social implications of environmental degradation to the plethora of issues raised by biotechnology, genomics, neuroscience and health, sociologists and social scientists are finding it difficult to ignore the "natural" world. Along with a wide range of treatments available in this field, the present ground-breaking text presents fresh perspectives challenging the way we think about the relationship among "time", "nature" and "society". Dirinck (2014) investigates the

relationship of exposure to persistent organic pollutants (POPs) with abnormal glucose metabolism and visceral adiposity, and the results supported the theory that exposure to environmentally relevant levels of POPs may contribute to the pandemics of T2D and obesity effect (Dirinck et al., 2014).

Structured programs that emphasize lifestyle changes involving dietary strategies can reduce the risk of T2D among individuals at high risk ("Diabetes Management in Clinical Practice,"). According to a population-based study in 2015, newly diagnosed diabetes was associated with a 16% increase in the risk of dementia among the elderly. Pre-existing vascular disease and severe hypoglycemia were the greatest risk factors for dementia in elderly patients with diabetes (Haroon et al., 2015).

C. Intervention in frailty and DM

Diabetes is a major cause of mortality due to cardiovascular and other diseases. In Taiwan, the Diabetes Shared Care Program (DSCP), an integrated diabetes care model, was designed to increase the quality of diabetes care, and included physicians, diabetes educators, and dieticians as participants. A study showed that participation in the DSCP was associated with lower risks of cardiovascular events, stroke, and all-cause mortality (Kornelius et al., 2015). However, elderly male participants with a history of hypertension, chronic lung disease, and prescription for insulin tended to have higher cardiovascular risks (M. Y. Chen et al., 2011). Currently, Taiwan has a strong referral system from community clinics to higher levels of care at fixed facilities, including hospitals with surgical capabilities, and a strong system of management and supervision led by competent professionals who control diabetes, collectively treating patients and clients with a high level of respect (Lai, 2012; T. T. Lee et al., 2010). However, Taiwan needs to develop a strong partnership among diabetes care programs, and it is necessary to establish

lower waist circumferences, more frequent exercise, and higher foot self-care capability among the most vulnerable communities to be associated with superior health indicators. Moreover, stronger training and greater support of community-based workers are required, because they are integral to the program (M. Y. Chen et al., 2011). Dauvrin et al. (2015) reviewed the studies conducted between 2005 and 2014 on chronic care model interventions for T2D self-management support that appraised the existence of cultural tailoring within these interventions, not only at the individual level. It remains necessary to address the organizational level more effectively (Dauvrin et al., 2015). A meta-analysis of diabetes self-management programs demonstrated an ecological perspective in which the long-term success of self-management depends on the context of an individual (Norris, Lau, Smith, Schmid, & Engelgau, 2002). For instance, access to resources and the continuity of quality clinical care; must be addressed at the group, health system, community, or policy levels; policies influence the resources and choices available to individuals and individuals thereby learn skills to access these resources (Lorig & Holman, 2003).

D. Quality of diabetes care

Complications from diabetes can have a marked detrimental effect on individuals' QOL; health problems to be addressed in diabetic patients include HbA1c levels, blood pressure, LDL, microalbuminuria, body weight, and other general health status factors. American Diabetes Association (ADA) guidelines suggest that A1c should be determined at least twice a year in patients with stable glycemic control who meet treatment goals and quarterly in patients whose therapy has changed or who are not meeting glycemic goals. For blood pressure control, the ADA

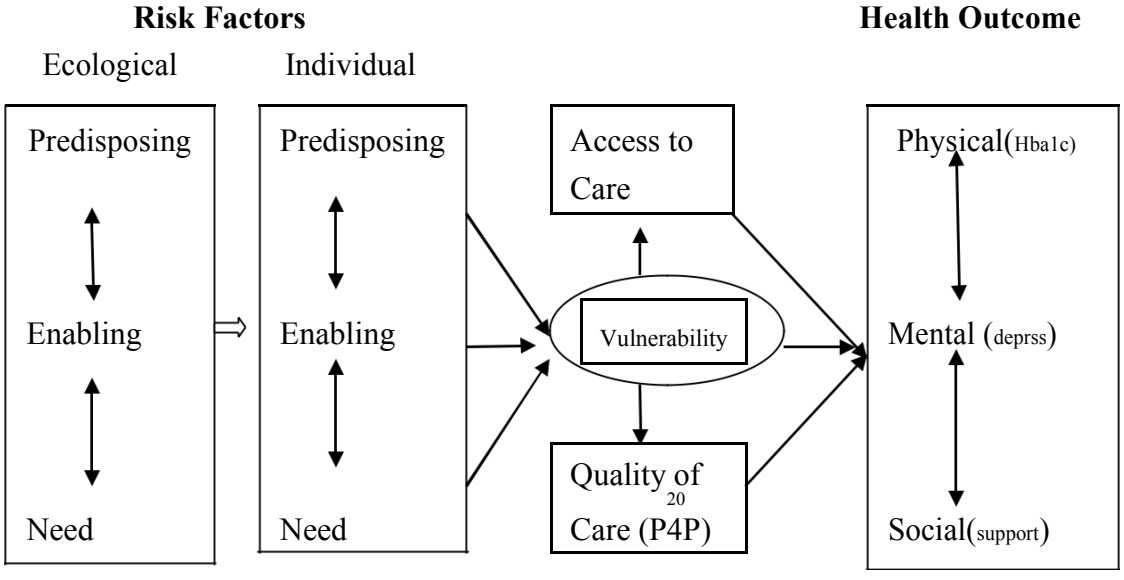
recommends that hypertension should be treated to systolic and diastolic blood pressures of <140 mmHg and <80 mmHg, respectively. For lipid levels, the ADA recommends the following goals for individuals without overt cardiovascular disease: LDL cholesterol <100 mg/dL, HDL cholesterol >50 mg/dL for women and >40 mg/dL for men and triglycerides < 150 mg/dL (Rao, Sunio, Lo, & Gossain, 2015). Clinical judgments and guidelines for managing T2D include lifestyle modifications that involve diet, exercise, a system for monitoring preprandial and postprandial blood glucose and HbA1c levels, and pharmacological interventions when required (Yacoub, 2014). A study analysis of trends in managing the attitudes and practices of patients suggested addressing gaps in the perception, knowledge, and management practices through education. Most health care providers lack confidence in using insulin regimens that are more complex than long-acting insulin alone. All the providers must be educated in T2D management guidelines. Pharmacists might benefit from education about glycemic treatment goals (Williamson et al., 2014). Over 12 months, the primary care clinic reported a higher increase in the proportion of patients achieving good glycemic control (HbA1c target ≤7%) than did the hospital clinic [Increase from 21% to 42% (P < .001) vs. 38% to 39%, (P = .99)] (Russell et al., 2013). Furthermore, higher numbers of primary care patients achieved better blood pressure and serum cholesterol control than did hospital clinic patients. A major redesigning of existing work practices and reconfiguring of professional roles and skills is required to achieve these results (Russell et al.,

2013). T2D, a chronic progressive metabolic disorder, is characterized by insulin resistance and impaired insulin secretion. T2D is caused by a complex interaction between genetic factors and the environment (Chowdry, 2014). The implementation of Taiwan NHI (2002-2012) has facilitated equal access to the health care system; however, it now faces new challenges regarding quality of care and efficiency of payment. In addition, democratic development has lead to active public involvement in social insurance, particularly in the field of patient-centered care, health care quality, and information transparency (K. Glanz, Rimer, & Viswanath, 2008). In all patients with diabetes, cardiovascular risk factors, including dyslipidemia, hypertension, and albuminuria, should be assessed at least annually (Chowdry, 2014). A comprehensive approach to enhancing diabetes care services developed in a health system included handouts and manuals, out-patient programs, Web-based programs, telephone or nurse educator case management, financial incentives for physicians' meeting the testing guidelines, and patient incentives for annual eye examination. The multi-level interventions led to an improvements in various outcomes (Larsen, Cannon, & Towner, 2003).

Conceptual framework

Shi and Stevens (2005) built an Aday's model while creating a general framework for studying vulnerable populations. In this model, both individual and ecological/environmental

risk factors influencing a person's vulnerability status are considered. For vulnerable populations, access to care and quality of care are often weak, and these differentials affect both individual- and population- level health outcomes. For instance, family characteristics, family life cycle and family community and society, which includes social networks, community characteristics, and social policy (such as health care, education, and housing) that affect a family's life quality. Elderly health outcomes are shaped by elderly people's innate biological and psychological characteristics, community and society, and physical, social, and cognitive conditions. Moreover, ethnic minority groups typically exhibit inadequate glycemic control and lower adherence to treatments, and are frequently hospitalized for severe glycemic trouble; therefore, they have a greater risk of retinopathies, renal disorders, neuropathies, amputations, and premature deaths due to T2D (Bellary et al., 2010; Campbell et al., 2012; Kanaya et al., 2011; Long, Gracely, Newschaffer, & Liu, 2013) Social context influences the degree of vulnerability and therefore a holistic approach to enhancing vulnerability outcomes is required.



General framework for studying vulnerable populations

Source: Shi and Stevens (2005)

The health of any population is affected by its environment. Evidence-based ambulatory guidelines have been developed for quality diabetes care, including the management of glucose, lipid levels, and blood pressure. Reduced fertility and a rapidly increasing number of middle-aged and elderly people with chronic disease dominated patterns have been observed in Taiwan. This study's conceptual framework entails maximizing the improvement in diabetes care in the Keelung community. Structured programs emphasizing lifestyle changes with dietary strategies can reduce the risk of diabetes among individuals at high risk. From an ecological perspective, patients with diabetes need diverse resources and supports for self- managing the disease in their daily lives. These include individualized assessment, collaborative goal-setting, opportunities to learn skills for checking blood sugar and managing negative emotions, ongoing follow-up and support, community resources such as those for regular physical activity and healthy diet, and continuity of quality clinical care. Individualized assessment and collaborative goal setting are mostly addressed at an individual level while others, such as access to resources and continuity of quality clinical care, must be addressed at the group, health system, community, or policy levels. Consistent with the ecological model's emphasis on interactions among levels, policies

influence the resources and choices available to individuals, and individuals thus learn skills to access these resources.

Ongoing follow-up and support for adequate self-management are among the effective recommended components of diabetes self-management. However, without self-management, clinical care does not achieve its potential, failing to realize healthful behavior patterns,(e.g.,increased physical activity or healthy diet, and nonadherence to the recommended use of prescribed medication, respectively).

Environmental and patient' behavioral characteristics:

1. Predisposing factors affecting diabetes adherence: Obesity and sedentary lifestyle (socioeconomic development), knowledge and perceptions about diabetes (self-image), perceived DM risk, perceived DM seriousness, diabetes health beliefs about barriers, self-efficacy, absence of psychological problems, medication, and smoking and alcohol consumption.
2. Enabling factors: Family social support and the advice of peers, primary care physicians, and health care providers who promote self-management. Understanding of diabetes and environmental factors affecting it.
3. Need: Access to diabetes clinics and supplies, interpersonal relationships, personal health responsibility, skill to conduct glucose monitoring and foot care, exercise, diet and adherence to recommended regimens.

Intervention in vulnerability at Keelung Chi-Du District (Process Part)

The diabetes prevention trials, involved intensive individualized interventions, which are

less expensive, and community group-based lifestyle interventions, which are health policies adopted by the Keelung Health Bureau since 2011.

1. Body weight loss: An obese/overweight person must aim to lose 5%-10% of their initial body weight continue to lose weight until their BMI is in the normal range, and maintain this weight loss.
2. Physical activity: Aim to perform moderate physical activity such as walking, cycling, aerobics, or dancing for at least 150 min/week, which promotes healthy aging.
3. Diet: Increase the intake of fibers (vegetables, fruits, wholegrain bread, cereals and beans). Reduce the intake of salts and saturated fats and consume fish and lean meat.
4. Avoid tobacco, alcohol and betel.

On June 21, 2014 the Sweet Family group was established, with a total of 77 participants. Participating in primary care by being a Sweet Family group member involved undergoing interventions to promote foot care, blood glucose self-monitoring, medication adherence, and physical activity while reducing smoking and alcohol consumption, which may substantially reduce the excess burden of medical complications of T2D.

Study Aims and Hypothesized Relationships Between Study Variables

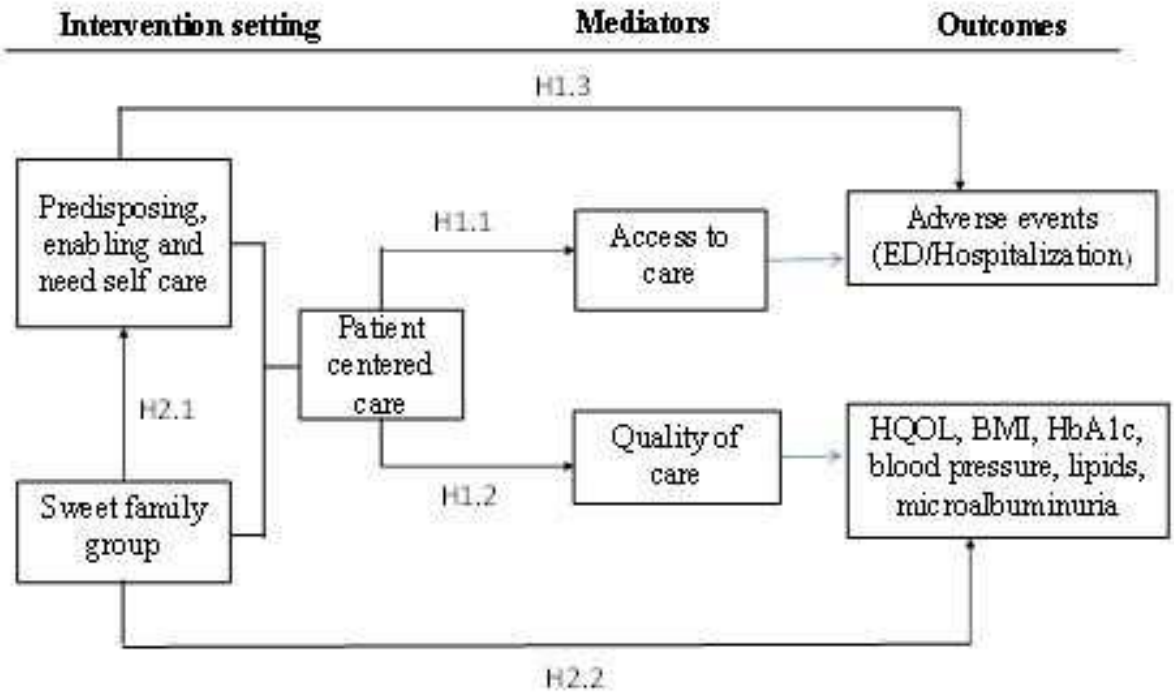


Figure 1 Conceptual framework for evaluating T2D care in Keelung Chi-Du District

Numerous self-care measures are required to control T2D progression and complications. The goal of self-care behaviors in diabetic patients greatly emphasizes the maintainence of appropriate blood glucose levels and prevention of complications. Patient characteristics (predisposing, enabling and need) prior to T2D self- management interventions, including age, sex, formal education, duration of diabetes (years), treatment and comorbidities, and lifestyle

culture, are crucial factors for T2D and its utilization (H2.1). Primary health care practitioners in hospitals and communities are the central providers of health-promoting self-care behaviors care for most patients with T2D, which are associated with T2D adverse utilization, self-management, and QOL (H2.2).

Maintaining harmonious relationships between self and others is crucial for Chinese individuals (Wong, Stewart, & Furler, 2009), and encourages access to care (H1.1). Understanding the needs of inpatients with diabetes assists nurses in designing health promotion intervention programs (H1.2). Cultivating health-promoting behaviors is recognized as a crucial strategy for maintaining and enhancing the QOL of people with chronic disabilities (H1.3). In this study, diabetes health promotion self-care behavior was conceptualized as a set of behaviors exhibited by patients with T2D for improving their physical and psychosocial well-being, which consists of physical activity, nutrition, blood glucose self-monitoring, adherence to recommended regimens, foot care, and personal health responsibility. Interpersonal relationships can complement improving the physical and psychosocial health of patients with diabetes (Wang, Lin, Cheng, Hsu, & Kao, 2012). Interpersonal relationships were defined as behaviors that maintain meaningful relationships with others. Personal health responsibility was defined as behaviors actively involved in health-benefitting actions. This study tested the psychometric properties of the Chinese version of Diabetes Health Promotion Self-Care Scale (DHPSC) and

Perceived Therapeutic Efficacy Scale (C-PTES) for two groups of T2D patients (the experimental sweet family group was the Chi-Du district community-based multidisciplinary health care team practice group and the control group was the elderly patients with T2D, who did not attend the class regularly).

Hypotheses/Research questions

We tested the hypothesis that participating in sweet family group reduces adverse health care utilization and health promotion self-care. This study has several hypotheses that are listed below:

Hypothesis 1.1 Patient centered care for interpersonal relationships in T2D patients is associated with the access to T2D care by the elderly in the Chi-Du District.

Hypothesis 1.2 Patient centered care for health promotion self-care in T2D patients is associated with the quality of T2D care received by the elderly in Keelung, and trained nurses can provide adequate interventions to enhance the behaviors of T2D patients.

Hypothesis 1.3 Predisposing, enabling and need for adherence to the recommended regimens in T2D patients are associated with fewer adverse health care utilization events in the elderly in Keelung.

In addition, to understand whether patient characteristics exhibited by participating in

sweet family groups affect health care utilization, two hypotheses are described.

Hypothesis 2.1 Group participation (the experimental group was the Chi-Du district community-based multidisciplinary healthcare team practice sweet family group, and the control group comprised elderly patients with T2D who did not attend the class regularly) is associated with predisposing, enabling and need for health promotion self-care in T2D patients in Keelung.

Hypothesis 2.2 Group participation (the experimental group was the Chi-Du district community-based multidisciplinary healthcare team practice sweet family group and the control group comprised elderly patients with T2D who did not attend the class regularly) is associated with T2D-related complications, adverse utilization and self-management, and QOL.

This study was a descriptive survey using a questionnaire with a cross-sectional correlation study design, focusing on the analysis of factors influencing community T2D patient's glycerol control and QOL. The survey consisted of several interrelated statements that attempt to describe, explain, and predict a phenomenon. Its purpose is to provide a framework for selecting the study variables, including how they relate to one another, as well as to guide the development of the interventions in experimental studies.

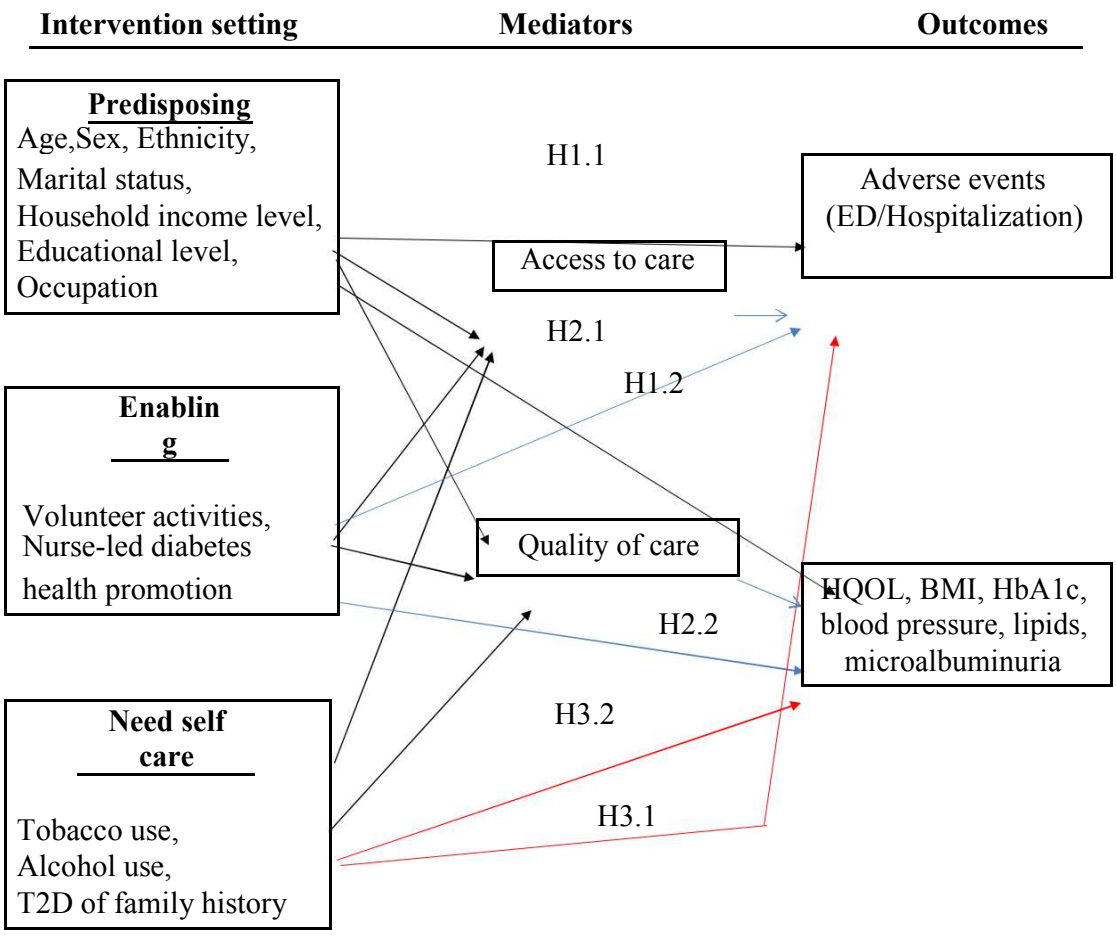


Figure 2 Analysis of factors influencing community T2D patient's glycerol control and QOL

The mediating variable is the variable through which the intervention functions and that positively affects T2D patient's outcomes. It was expected that the T2D patients who participated in the sweet family program would have better coping outcomes than those who did not. Thus, through this empirical evidence, support for the effectiveness of the cope program was generated in addition to data that explain how the intervention affects T2D patients and family outcomes. The sweet family demographic variables that predict successful QOL were thereby

identified. As were likely behaviors during and following T2D glycerol control.

Methods

Chi-Du Community Risk Factor Assessment

The qualitative evaluation and participatory action research were participatory in nature. The researcher is a 65-years-old diabetic patient living in Keelung. She was a consultant in the Keelung City Government Health Bureau community health-building program from 2011 to 2014, engaged in helping others with diagnose, and providing them with support. Furthermore, she promoted the community services and programs that are available to the families of diabetic patients. She was able to systematically identify demographic characteristics, health behaviors, health conditions, and diabetes care associated with life satisfaction among non-institutionalized elderly people in Keelung in 2012. She believes in the concept of "community as partnership" and therefore, she asked stakeholders to examine the question "Why has diabetes mortality increased sharply in Keelung?" A director of a community development organization answered that it was due to numerous factors, stating that "the number of elderly people has recently drastically increased, most people eat outside food, and their diets lack vegetables and fruits; moreover, there is rainfall for over 200 days per year, which limits exercising opportunities". We need strategies that integrate health care and community approaches to reduce diabetes disparities because patients from low socioeconomic regions with a high prevalence of inadequately controlled T2D suffer from avoidable complications because of lack of timely access to specialized care.

It is necessary for researchers to conduct a community windshield survey, which includes the community's physical environment, education, safety and transportation, politics and government, health and social services, communication, economics, and recreational facilities

(Anderson, 2004). Selecting community health workers driven by political consideration is a challenge. Keelung City lacks persistent supervision and support, strong assessment tools for community health work programs with program adjustments made according to these assessments, and extensive political and financial support for sustainability. For example, elderly-friendly sidewalks could be constructed to improve the environment and avoid obesity in the community.

Ideally, solutions can be identified that involve community participation, including community health centers, community surveillance volunteers, nutrition counselors, physical exercise counselors, and diabetes clubs. Vertical and horizontal programs must co-exist. Discovering a locally appropriate method for linking the vertical and horizontal approaches in a manner that is equitable, engages communities as partners, and promotes community empowerment by linking the top-down, and bottom-up models is necessary. Trust between health care system employees and the community must be strengthened. According to Arole and Arole, (1994) “medicine must be demystified and knowledge must be shared freely with people”. Therefore, team spirit and equality should be fostered and maintained.

The proposed plan concerns diabetic patients in Keelung City. The short-term goal of the plan is to actively raise diabetes care awareness within the community. Through the primary

health centers in seven districts of Keelung, a survey of 173 randomly selected elderly people in healthy living conditions was conducted in 2012. The survey analyzed elderly people with diabetes and without diabetes and differences in their lifestyle.

Baseline characteristics of elderly population in Keelung comparing residents diagnosed with diabetes to those without diabetes

Characteristic	No diabetes (n=126)	**Diabetes (n=47)**	**χ2**	**P Value**
Region	N (%)	**N (%)**		
Zhong shan	23（18.25）	**5（10.64）**		
Xin yi	27（21.43）	**7（14.89）**		
Nuan nuan	13（10.32）	**4（8.51）**		
Zhong zheng	12（9.52）	**8（17.02）**	**8.17**	**.226**
Ren ai	15（11.90）	**11（23.40）**		
On Lok	19（15.08）	**4（8.51）**		
Chi du	17（13.49）	**8（17.02）**		
Gender	N (%)	**N (%)**		
Female	85（67.46）	**33（71.74）**	**0.29**	**.593**
Male	41（32.54）	**13（28.26）**		
BMI	N (%)	**N (%)**		
Normal weight	71（63.96）	**22（55.00）**	**0.99**	**.318**
Overweight/obese	40（36.04）	**18（45.00）**		
Smoke				
Never	110（88.71）	**41（87.23）**	**0.07**	**.789**
Ever	14（11.29）	**6（12.77）**		
Education	N (%)	**N (%)**		
Lesser than high school	78（62.40）	**26（59.09）**	**0.15**	**.698**
Higher than high school	47（37.60）	**18（40.91）**		
Self-management	N (%)	**N (%)**		
Participated	30（26.09）	**23（50.00）**	**8.51**	**.004**
Not participated	85（73.91）	**23（50.00）**		
DM knowledge	N (%)	**N (%)**		

Correct	95（79.83）	**41（89.13）**	**1.98**	**.159**
Incorrect	24（20.17）	**5（10.87）**		
Exercise				
Yes	71（69.61）	**26（66.67）**	**0.11**	**.736**
No	31（30.39）	**13（33.33）**		
Foot checked by family members.	N (%)	**N (%)**		
Yes	7（6.25）	**13（28.26）**	**14.29**	**<.001**
No	105（93.75）	**33（71.74）**		
Characteristic of life	Mean（95% CI）No diabetes	**Mean（95% CI）Diabetes**	**t value**	**p value**
Age (years)	67.38（65.64-69.13）	**70.30（67.47-73.12）**	**-1.74**	**.042**
Vegetable amount(3/day)	0.88（0.70-1.05）	**1.10（0.79-1.42）**	**-1.32**	**.094**
Fruit amount(2/day)	0.76（0.57-0.95）	**0.70（0.39-1.01）**	**0.32**	**.63**
BMI (kg/m2)	24.37（23.77-24.98）	**24.88（23.56-26.20）**	**-0.78**	**.22**
Income	1.59（1.39-1.79）	**1.44（1.11-1.77）**	**0.76**	**.78**
Depression days (days depressed in past months)	1.14（0.40-1.87）	**1.10（-.29-2.51）**	**0.04**	**.52**
Body pain days. (days in month)	1.16（0.44-1.89）	**1.22（0.03-2.40）**	**-0.08**	**.47**
Satisfied health service rating（1-5）	2.74（2.47-3.01）	**2.76（2.38-3.14）**	**-0.09**	**.47**

The findings were discussed with community health nurses and partners. Through empowerment, we can influence and reshape the social environment to address health disparities

among the most vulnerable people in our society. The implementation strategy includes reaching out to every household affected by diabetes; visiting every residence regularly, checking blood sugar levels, medication, nutrition, oral hygiene, foot care, physical exercise, and ensuring fall prevention; recording vital events through home visits; using this information to ensure the program involves a high level of trust and psychological support; developing strong partnerships with communities; evaluating progress achievements and challenges related to the group; monitoring the effects of intervention; and measuring HbA1c and health behavior improvements. At Jun 21, 2014 we set up a non-governmental organization (NGO), Sweet Family, which is a primary physician group for the Chi-Du community that includes chronic disease patients, families, and health care professionals focused on diabetes prevent programs with the purpose of avoiding complications, enhancing medical outcomes, and improving QOL. On March 21, 2015 the researcher partook in a discussion with a diabetes patients' club, primary physician, and community health nurse for the first time at the Chi-Du community health center. Such discussions built trust and hope and focused on sharing knowledge between local people and outsiders. Furthermore, they enabled development managers and local people to assess and plan appropriate interventions collaboratively. Stakeholder analysis is a starting point of most participatory work and social assessments.

Sweet Family intervention programs

We conducted an intervention at the Keelung Chi-Du community health center. Chi-Du is the largest district in the southern Keelung area and comprises primarily mountains and hills (80%), and is a low socio-economic status suburb of outer urban Keelung with a high ethnic and indigenous population. Patients included both new and existing patients of the community clinic. The intervention was provided by a multidisciplinary team, applying community-based model of care led by a nurse practitioner with advanced skills and involved partnerships with community health workers. This was performed in a primary and tertiary care setting in Chi-Du. Sweet Family is a community NGO, with 143 participating members, who consist of families of diabetes patients, concerned chronic care medical personnel, and 77 patients diagnosed with diabetes. However, based on the attendance register, typically 60-70 people attend activities. Sweet Family works in collaboration with health care professionals. Organization is group-based, with a maximum of 10 participants. Currently, there are eight groups, with group leaders who are proficient at blood glucose control and enthusiastic about diabetes prevention, who are responsible for notifying about meeting times, teaching about diet, exercise, whether to take medicine, and caring for blood pressure, blood glucose measurement, daily diet recording, and identifying the need for assistance. The program conducted during the first year covered two main objectives: (1) generic self-efficacy enhancement and lifestyle modification and (2)

disease-specific knowledge and skills. On the third Saturday of each month at the Chi Du health center at 7:30 am, fasting blood sugar checks were conducted, and healthy breakfast sandwiches were provided; at,8:00 am, chronic disease prevention seminars were organized, including health education activities; and at 9:30 am, a coach lead an exercise routine for 1 hour. The sessions from July, 2014 to June, 2015 included health education focused on nutrition and diet; teaching skills and understanding the principles of diet, festivals and dietary considerations; gout and degenerative arthritis health education; sharing self-monitoring and care experience; understanding diabetic retinopathy, foot care; and walking trail activities. Moreover, Keelung City Health Bureau co-sponsored the Lions Club International Diabetes Awareness and vision care activities entitled “Good Mountains, Good Water, Good Scenery”. The educational resources and curriculum were designed by the primary physician and community health nurses, Keelung miner hospital dietitian examined participants’ daily diabetic diet records and provided individual advice. Ching Kuo Institute of Management and Health designed physical exercises for body weight control, which were revised and updated regularly in order to tailor the material for the diabetic patients in Chi-Du district. Patient-centered care is respectful of and responsive to individual patient preferences, needs, and values and ensures that patient values guide all decision making ("Person-Centered Care: A Definition and Essential Elements," 2016).

Study design

This cross-sectional observational study investigated diabetes health promotion self-care behaviors, perceived therapeutic efficacy, and clinical outcomes among patients with T2D in Chi-Du District, Keelung. We hypothesized that Sweet Family provides superior quality of care and better patient outcomes compared to standard care at primary care clinics. Taiwan launched a compulsory NHI program in 1995, which covers 99% of the population and reimburses outpatient and inpatient services, as well as prescription drug costs. The Diabetes Shared Care Program (DSCP) is a form of P4P, that was implemented nationally in 2001, but was implemented by physician groups in Chi-Du in 2004. All diabetes caregivers must be validated and certified according to specific diabetes training courses. Qualified physicians at community clinics can enroll diabetes patients into the program. According to Chi-Du District of Keelung health center, a total of 997 cases were recorded in the DSCP at 2015. Participating patients are required to attend a clinic every 3 months for adjustment of drugs by a physician, and to receive diabetes education from a diabetes educator, as well as a diet consultation with a dietitian. Also, blood pressure, HbA1c and blood sugar checks are arranged every 3 months. Furthermore, retinal examination, foot examination, lipid profile and renal function examination are arranged annually. Incomplete clinical and laboratory data result in failure to receive the benefits of the DSCP. With respect to the Sweet Family and standard care, the two study groups were similar at

baseline. The main difference between the two groups was the continual information sharing and integrated communication. For example, the dietitian examined daily diabetic diet records and provided individual advice, and the physician checked the daily blood sugar and blood pressure record to adjust treatment, conducting an ongoing review of the participants' goals and care plan.

The purpose of this study is to understand why diabetes patients do not want to join the Sweet Family. And with the evidence basis to confirm the benefits of joining the Sweet Family. Mixed methods can be useful for research questions that call for real-life contextual understandings, multi-level perspectives and cultural influences. To determine the perspectives and experience of DM patients and health care professionals regarding the self- management of diabetes.

Study population

A total of 997 people participated in the DSCP from Chi Du district clinics; Sweet Family had 77 participants, leaving 920 people for the control group. Selection criteria included subjects' being diagnosed with T2D by a qualified physician, having measured HbA1c levels twice from the year prior to enrollment and willingness to participate. Exclusion criteria included type 1 diabetes, gestational diabetes, bariatric surgery, severe mental problems, severe diabetes complications, and inability to walk to the Chi-Du health center. For reduced selection bias,

random matched controls were applied with a 1:1 ratio by using propensity score matching, including variables for age, sex, monthly income, comorbidity, and antidiabetic drugs (n=77). Logistic regression adjustment was applied, facilitating a more accurate evaluation of the effectiveness of the Sweet Family. Patients who did not participate in Sweet Family, but received DSCP treatment numbered 920; they sought medical attention from a qualified physician in a Chi-Du community clinic. The main difference between the participants and nonparticipants was the receiving integrated community resources for diabetes team care, and frequent monitoring and follow-up analysis, as well as participating in monthly activities at Chi-Du community health center. The patients first contacted the Keelung primary health center, which addressed the primary causes of T2D, including education, nutrition, exercise, BMI and waist circumference, and peripheral neurological assessment, and evaluated the social, community, household, and behavioral determinants of their health. Thus, the approach entails being responsive to local community needs. Moreover, sector-specific (local agriculture, health walking roads, health literacy), plans were applied to identify diabetes affected elderly people in the community. The primary end point was the HbA1c concentration at 12 months, and the secondary end points included serum lipids and blood pressure. Otherwise, the 2013 American Geriatrics Society Guidelines could be applied to improve the care for DM and present stronger, more-prescriptive, patient-centered recommendations for lifestyle modification, based on increased evidence of

their importance for healthy older adults with DM (Moreno, Mangione, Kimbro, & Vaisberg, 2013).

Sample size calculation assumption

According to the study "10-year Follow-up of Diabetes Incidence and Weight Loss in the Diabetes Prevention Program Outcomes." effect size was reduced by 0.34 in the lifestyle group (Knowler et al., 2009). Based on an alpha value of 5% and power of 80%, a total of 90 patients were needed to detect change in body weight. A ratio of 1:1(Sweet Family to standard) has been chosen so that the community clinics at the intervention sites maintain reasonable and sustainable capacity. Due to human and material constraints can't reach 90 people.

Quantitative data collection

Patients were screen via phone, using patient permission information sheets with consent forms and visiting participants at home or health center visit face to face to collect them, with researchers and community health workers visiting together. Retrospective review was conducted on Sweet Family and standard care patient charts at the three Chi-Du community clinics. The study questionnaire queried the patients about their sex, age, ethnicity, household income, employment status, level of formal education, duration of diabetes since diagnosis. In

addition, patients were asked whether they were on anti-diabetic medications, insulin regimens, had chronic complications such as retinopathy, neuropathy, nephropathy, amputation, diabetes related cardiovascular disease, or acute complications, and had experienced hypoglycemia or hyperosmolar hyperglycemic non-ketotic coma. Information regarding health services use, date of discharge from clinic (if applicable), and allied health referrals were collected (Sijhih Cathay General Hospital, Keelung Chang Gung Memorial Hospital, and Ministry of Health and Welfare Keelung Hospital) Data were partially collected from clinical records and partially from patient surveys.

The laboratory data (HbA1c, lipid levels, and microalbuminuria) were obtained as part of routine clinical care of the study participants and were produced at local clinical laboratories. Each patient's height, weight, blood pressure, serum cholesterol, serum creatinine, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL) levels, estimated glomerular filtration rate (eGFR), and numbers of visits to nursing diabetes specialists and dietitians were abstracted from their medical records. Data were collected retrospectively for up to 12 months prior to the most recent visit for each patient.

Patient-reported outcomes

Patients not only completed the DHPSC questionnaire on demographic, social, and

environmental characteristics that are believed to be predisposing, enabling and health need factors, that affect diabetes self-care and perceived therapeutic efficacy but also completed the WHOQOL-OLD, which is well suited to identifying the needs and wishes of an aging population. A Chinese version was evaluated in the general population of Gaungzhou and showed good feasibility, reliability and validity (Liu et al., 2013). The questionnaires were self-administered, or interviewer-assisted, if required. The mean time for completing the questionnaire was 30-40 minutes.

After providing written informed consent, participants completed the psychometric test of the Chinese version of the DHPSC, which assesses seven sub-scales: interpersonal relationships, diet, blood glucose self-monitoring, personal health responsibility, exercise, adherence to recommended regimens, and foot care. WHOQOL-OLD assesses six domains: sensory ability, autonomy, past, present and future activities, social participation, death and dying, intimacy. These factors were rated on a 5 point Likert scale.

The DHPSC, C-PTES, and WHOQOL-OLD have satisfactory reliability and validity. Exploratory and confirmatory factor analyses were performed to assess the construct validity of this scale. The DHPSC satisfaction subscale of the Diabetes QOL, and Diabetes Empowerment Scale were significantly correlated, and HbA1c was only statistically significantly correlated

with the subscale of health responsibility. Reliability was supported by an acceptable Cronbach's alpha of .78-.94 (Wang et al., 2012). The WHOQOL-OLD showed a satisfactory construct validity of 0.95 in confirmatory factor analysis, and exhibited reliability with a Cronbach's alpha of .71-.84 (Liu et al., 2013). The C-PTES was conceptualized as an individual's confidence in their ability to control diabetes or prevent complications. The instrument measures self-efficacy towards management of diabetes, focusing on activities of people with T2D who are taking prescribed medication. Construct validity using factor analysis produced a single subscale (10 items all loaded above 0.40) and accounting for 71% of the variance was acceptable. Internal consistency showed a Cronbach's alpha of .95 and test-retest reliability (Pearson's correction) was 0.79 ($p< 0.01$) (Wu et al., 2008). The DHPSC, C-PTES and WHOQOL-OLD were self-administered, unless a respondent required interviewer assistance. The mean time for completing the questionnaire was 50 minutes.

Human Subject Protection and Data Collection Procedure

The study protocol was sent to the Institutional Review Board of the University of Taipei for approval on July 1, 2016(IRB-2016-029) and the Review Board of Johns Hopkins University for approval (IRB00007873). Informed consent was obtained from all subjects.

Participants were notified about the survey by community health nurses and primary physicians, and a cover letter was sent together with the questionnaire that assured participants their responses would be kept confidential and that they would have 3 days to 1 week to consider their responses. Participants could review the questionnaire with family members and determine willingness to continue participating. Only those who gave consent participated in the research procedure, which involved: measuring and collecting health indicators, responding to questionnaires, and face-to-face interviews. Data encoding was used to maintain confidentiality during data analysis. Data were collected from August 1, 2016 to January 21, 2017.

Main outcome measures

Key Measures

The independent variable was whether the out patients were one of the 71 people who participated in the Sweet Family group or were one of the 84 diabetic patients who did not attend the Sweet Family group. Adherence to the recommended regimens, blood glucose self-monitoring, foot care, exercise, diet, personal health responsibility and interpersonal relationships subscales were rated on the DHPSC, C-PTES, and WHOQOL-OLD and were used to evaluate whether primary health care practitioners provided high quality diabetes care. Recommended screenings included the HbA1c test, cholesterol test, eye examination, and an annual urine microalbumin test, which are covered under the P4P policy in Taiwan. Furthermore, we collected information on the related characteristics of T2D patients, namely age, sex, formal education, duration of diabetes, and whether they had experienced acute and chronic complications and attended nurse-led diabetes sessions. The basic characteristics and the result of patients' most recent documented lab examination were entered into SPSS Statistics software (Inc., 2009).

An independent *t*-test was used to compare differences in the means between the group metric data, and the X^2-test was used to compare differences between the groups for categorical data. The average DHPSC**,** C-PTES, and WHO QOL-OLD scores were then tested for

statistically significant differences between the groups using an independent *t*-test, and this association was also assessed through multiple regression analysis.

Results

The mean age was 67.39 years (SD: 10.02) in Sweet Family group and 67.93 years (SD: 10.65) in the standard care T2D support group. The basic characteristics of the 155diabetes patients by group are shown in Table 1. These characteristics were relatively balanced between the patients attending Sweet Family and patients received standard care in Keelung, but this was in the context of a predominantly low socio-economic status community in Taiwan. Household income level and educational level is low in this community. Significant differences in educational level, participation in community activities and health education curricula, Sweet Family education is higher; more active participation in community volunteer and to participate in diabetes health education courses. During the period of getting diabetes, the Sweet Family was longer than the control group for about 5 years, reaching a significant difference.

Table 1. Distribution of characteristics for diabetic patients attending Sweet Family and patients received standard care in Keelung

Characteristics	Sweet family group	Standard care support group.	total	χ^2	p value
Mean of age (years)	67.39±10.02 SE=1.67	67.93±10.65 SE=1.66	67.68±10.34 SE=0.83		0.75
Sex				2.622	0.105
male	21(29.6%)	35(42.2%)	56(57.1%)		
female	50(70.4%)	48(57.8%)	98(42.9%)		
	71	83			
Ethnicity				2.817	0.093
Aboriginal	9(12.7%)	4(5.2%)	13(8.6%)		
Taiwanese	62(87.3%)	76(94.8%)	138(91.4%)		
	71	80			
Marital status				1.268	0.620
married	53(74.6%)	53(66.3%)	106(70.1%)		
others	18(25.40%)	27(33.7%)	45(29.9%)		
	71	80			
Living arrangement				2.272	0,132
alone	12(16.9%)	7(8.8%)	19(12.5%)		
with others	59(83.1%)	73(91.2%)	132(87.5%)		
	71	80			
Household income level				5.913	0.206
<20000	11(15.7%)	16(20.0%)	27(18.0%)		
20000-50000	34(48.6%)	48(60.0%)	82(54.7%)		
50000-70000	19(27.1%)	10(12.5%)	29(19.3%)		
70000-100000	2(2.9%)	1(1.3%)	3(2.0%)		
>100000	4(5.7%)	5(6.3%)	9(6.0%)		
Educational level				16.259	<0.001***
Low(primary school and below)	24(34.3%)	54(66.7%)	78(51.7%)		
Basic(junior and	36(51.4%)	23(28.4%)	59(39.1%)		

senior high school)					
high (junior college and above)	10(14.3%)	4(4.9%)	14(9.2%)		
Volunteer activities				30.584	<0.001***
yes	55(77.5%)	26(32.5%)	81(53.6%)		
no	16(22.5%)	54(67.5%)	70(46.4%)		
Employment				1.925	0.175
unemployed	12(16.9%)	21(26.3%)	33(21.9%)		
employed	59(83.1%)	59(73.7%)	118(78.1%)		
Familial DM				1.847	0.174
yes	30(52.6%)	40(66.7%)	70(59.8%)		
no	27(47.4%)	20(33.3%)	47(40.2%)		
Tobacco use				2.839	0.092
yes	3(4.2%)	11(13.4%)	14(9.2%)		
no	68(95.8%)	71(86.6%)	139(90.8%)		
Alcohol use				0.233	0.629
yes	10(14.1%)	15(18.3%)	25(16.3%)		
no	61(85.9%)	67(91.7%)	128(83.7%)		
Participation of DM health promotion sessions				56.732	<0.001***
yes	69(97.2%)	30(37.5%)	99(65.6%)		
no	2(2.8%)	50(62.5%)	52(34.4%)		
Duration of DM (years)	11.92±10.52 SE=1.51	7.22±7.43 SE=1.60	9.17±9.12 SE=0.77		0.002**

*p<.05; **p<.01; ***p<.001

For Table 2, two groups underwent blood and urine tests every 3 months. The results indicate that only fasting sugar, and triglyceride(TG) were significantly different. The Sweet Family group exhibited better control, although HbA1C was not significantly different. However,

participants in the Sweet Family group contracted diabetes more often than the control group over 5 years. This indicates that the DSCP does improved diabetes care quality.

Table 2. Comparison Between the Sweet Family group and standard care support group for routine laboratory test.

variable	Sweet family group	Standard care support group.	total	X^2	p value
BMI control				0.818	0.366
Healthy(<27)	42(43.3%)	55(56.7%)	97(100%)		
Poor(>27)	28(50.9%)	27(49.1%)	55(100%)		
Systolic pressure				0.499	0.480
Good (<140)	56(46.6%)	64(53.4%)	120(100%)		
Poor (>140)	11(39.3%)	17(60.7%)	28(100%)		
Diastolic pressure				0.058	0.810
Good (<90)	63(45.0%)	77(55.0%)	140(100%)		
Poor (>90)	3(50.0%)	3(50.0%)	6(100%)		
Fasting Sugar				4.780	0.029*
Good (<130)	37(54.4%)	31(45.6%)	68(100%)		
Poor (>130)	30(36.6%)	52(63.4%)	82(100%)		
HbA1c				0.029	0.864
Good (<7%)	24(39.3%)	37(60.7%)	61(100%)		
Poor (>7%)	31(40.7%)	45(59.3%)	76(100%)		
Cholesterol				1.837	0.175
Good (<160)	16(37.2%)	27(62.8%)	43(100%)		
Poor (>160)	50(49.5%)	51(50.5%)	101(100%)		
TG				3.769	0.052*
Good (<150)	49(52.1%)	45(47.9%)	94(100%)		
Poor (>150)	18(35.2%)	33(64.8%)	51(100%)		
HDL				0.016	0.899
Good (>50)	25(39.7%)	38(60.3%)	63(100%)	遺漏值太多	
Poor (<50)	18(40.9%)	26(59.1%)	44(100%)		
LDL				0.897	0.344
Good (<100)	65(47.4%)	72(52.6%)	137(100%)		

Poor (>100)	0(0%)	1(100%)	1(100%)		
Serum creatinine				1.151	0.283
Good (<1.4)	54(46.9%)	61(53.1%)	115(100%)		
Poor (>1.4)	10(35.7%)	18(64.3%)	28(100%)		
B.U.N.				3.128	0.149
Good (<23.5)	15(83.3%)	3(16.7%)	18(100%)	資料遺漏太多	
Poor (>23.5)	4(50.0%)	4(50.0%)	8(100%)		
Estimated G.F.R.				1.617	0.204
Good (>60)	31(46.3%)	36(53.7%)	67(100%)		
Poor (<60)	23(35.4%)	42(64.6%)	65(100%)		
Urine microalbumin				0.053	0.842
Good (<2)	17(37.7%)	28(62.3%)	45(100%)	遺漏值太多	
Poor (>2)	24(40.0%)	36(60.0%)	60(100%)		
GOT				0.673	0.412
Good (<30)	27(46.5%)	31(53.5%)	58(100%)		
Poor (>30)	8(66.7%)	4(33.3%)	12(100%)		
GPT				0.292	0.589
Good (<35)	38(42.7%)	51(57.3%)	89(100%)		
Poor (>35)	8(36.3%)	14(63.7%)	22(100%)		

*p<.05; **p<.01; ***p<.001

Table 2.1 t-test for lab test

Variable	Sweet family group Mean ± SD	Standard care support group. Mean ± SD	t	P value
BMI	26.17±3.81	26.33±3.79	0.239	0.812
Systolic pressure	130.46±14.13	131.56±13.48	0.438	0.662
Diastolic pressure	75.31±9.163	75.95±10.29	0.359	0.720
Fasting Sugar	123.75±31.93	159.12±74.67	3.325	0.001***
HbA1c	7.31±1.17	7.71±1.86	1.334	0.185
Cholesterol	182.05±29.07	182.02±43.29	-0.005	0.996
TG	139.73±101.63	173.26±121.23	1.618	0.108
HDL-C	49.41±13.49	49.56±12.34	0.051	0.959
LDL-C	105.68±23.12	108.49±34.37	0.506	0.614
Serum creatinine	1.39±1.49	1.20±0.35	-0.988	0.325
B.U.N.	19.25±16.29	35.97±32.41	1.521	0.147
Estimated GFR	61.50±21.21	56.56±16.63	-1.363	0.176
Urine microalbumin	8.34±14.72	6.39±8.09	-0.798	0.427
GOT	28.55±15.45	30.09±19.48	0.340	0.735
GPT	27.92±22.61	28.12±19.23	0.045	0.964

In Table 3, there were significant differences for foot examination and seeing a dentist every 6 month for check-up and cleaning. Diabetic patients need to improve their daily inspection of the plantar, toenail cutting, walking more frequently to promote lower limb circulation, and prevention of infection from amputations. Every 6 months it is necessary to have their teeth cleaned and remove plaque to prevent periodontal disease and gum inflammation.

Table 3. Comparison Between the Sweet Family group and standard care support group for regular examinations (Annual Risk Assessment).

variable	Sweet family	Standard care support group.	total	X^2	p value
Dilated eye exam.(retinal photography)				0.752	0.386
yes	57(81.4%)	62(75.6%)	119(78.3%)		
no	13(18.6%)	20(24.4%)	33(21.7%)		
Foot exam.				8.349	0.004**
yes	36(51.4%)	22(28.2%)	58(39.2%)		
no	34(48.6%)	56(71.8%)	90(60.8%)		
See dentist every six months for check-up and cleaning.				17.000	<0.001***
yes	38(55.1%)	16(21.6%)	54(37.8%)		
no	31(44.9%)	58(78.4%)	89(62.2%)		
Elderly physical exam.				1.753	0.185
yes	63(91.3%)	63(84.0%)	126(87.5%)		
no	6(8.7%)	12(16%)	18(12.5%)		

*p<.05; **p<.01; ***p<.001

In Table 4, participants in the Sweet Family group had fewer comorbidities than the non-

participants (36.8% vs. 63.2%), with significant differences ($p<0.05$)., Sweet Family participants had longer duration of illness but fewer complications, particularly macular degeneration ($p<0.001$), peripheral neuropathy($p<0.01$), and renal disease($p<0.05$).

Table 4. Comparison Between the Sweet Family group and standard care group with respect to the experience of chronic complications

variable	Sweet family	Standard care support group.	total	X^2	p value
Whether there is a complication (as long as there is one of them)				9.754	0.02*
yes	35(36.8%)	60(63.2%)	95(100%)		
no	30(66.7%)	15(33.3%)	45(100%)		

*p<.05; **p<.01; ***p<.001

Table 4-1. Details of the complications

variable	Sweet family	Standard care support group.	total	X^2	p value
Hypoglycemia unconsciousness				<0.001	1
yes	4(50.0%)	4(50.0%)	8(100%)		
no	65(51.2%)	62(48.8%)	127(100%)		
M**acular degenerat**ion				65.768	<0.001***
yes	11(28.2%)	29(71.8%)	39(100%)		
no	53(55.2%)	43(44.8%)	96(100%)		
Peripheral neuropathy				7.910	0.019**
yes	14(30.4%)	32(69.6%)	46(100%)		
no	51(78.5%)	14(21.5%)	65(100%)		
Renal disease				5.106	0.024*
yes	21(34.4%)	40(65.6%)	61(100%)		
no	42(55.2%)	34(44.8%)	76(100%)		
Amputation				0.428	0.513
yes	0(0%)	2(100%)	2(100%)		
no	70(48.6%)	74(51.4%)	144(100%)		
Cardiovascular disease chronic complications				2.242	0.134
yes	20(37.7%)	33(62.3%)	53(100%)		
no	44(52.4%)	40(47.6%)	84(100%)		

*p<.05; **p<.01; ***p<.001

For Table 5, There were no significant differences regarding adverse utilization events at emergency visits (RR 2.115, 95% C.I. 0.702-6.371) and numbers of hospitalizations (RR 2.000, 95% C.I. 0.751-5.329) because of diabetes, but significant differences at length of stay of hospitalization for diabetes (0.064±0.277 vs. 3.77±1.023), and cost of hospitalization for

diabetes (mean=1824.6 vs. mean=12230.6) NT dollar.

Table 5. Comparison Between the Sweet Family group and standard care support group with respect to adverse utilization events

variable	Sweet family	Standard care support group.	total	t	p value
Numbers of emergency visits because of diabetes	0.11±0.059 n=64	0.23±0.072 n=73	0.20±0.05 n=137	-1.326	0.187
Numbers of hospitalizations because of diabetes	0.05±0.028 n=67	0.34±0.083 n=76	0.31±0.091 n=143	-3.351	0.001***
Length of stay hospitalization for diabetes.	0.064±0.277 n=67	3.77±1.023 n=77	2.31±0.575 n=144	-2.949	0.004**
Cost of hospitalization for diabetes	mean=1824.6 n=57	mean=12230.6 n=62		2.195	0.031*

*p<.05; **p<.01; ***p<.001

In Table 6, the two groups did not exhibit reach significant differences regarding treatment of diabetes, mainly using oral hypoglycemic drugs (66.7% vs. 81.6%). More patients with diabetes in Keelung are first treated with oral drugs, being less willing to receive injections of insulin. Sweet Family participants were more willing to accept insulin injection therapy, both oral and insulin (20.4% vs. 14.3%). Insulin is injected when the disease is severe. Myths about insulin use need to be challenged.

Table 6. Comparison Between Sweet Family group and standard care support group with respect to treatment (oral hypoglycemic agent, insulin, or both)

variable	Sweet family	standard care support group	total	X^2	p value
Oral hypoglycemic agent				2.763	0.096
yes	30(66.7%)	40(81.6%)	70(74.5%)		
no	15(33.3%)	9(18.4%)	24(25.5%)		
Insulin				1.770	0.183
yes	7(13.5%)	3(5.8%)	10(9.6%)		
no	45(86.5%)	49(94.2%)	94(90.4%)		
Both oral and insulin				0.712	0.398
Yes	11(20.4%)	8(14.3%)	19(17.2%)		
no	43(79.6%)	48(85.7%)	91(82.8%)		

*p<.05; **p<.01; ***p<.001

In Table 7, There were significant differences between the two groups regarding relationships, diet control, regular exercise, foot care, blood glucose self- monitoring, and adherence to recommended regimens. Although personal responsibility did not reach significant differences, the Sweet Family scores are nevertheless high. Because participants joining the Sweet Family group have to provide blood glucose testing machine and test strips results, members must learn to measure their own blood glucose, blood pressure and dietary records. Chi-Du District Health Center do Diabetes educators registered the results, and the dietary records are transferred to the

hospital dietitian for review. Monthly family reunions are used to provide advice and guidance, developing individuals' capacity to choose the right foods. Every Monday, Wednesday and Friday, from 9:00 am to 10:00am, teachers from the Keelung Cheng Kuo University teach community members to perform stretching exercises and aerobic exercises to promote heart and lung function. Sweet Family gatherings occur on the third Saturday morning of each month, and involve listening to panel discussions held by professionals, dieticians, pharmacists and nurses, who not develop participants cognitive and self-care skills but also exchange experiences, promote motivation, develop interpersonal relationships and clarify issues and myths such as whether to inject insulin and how to eat. In addition, 1 hour of sports and games not only promote interpersonal relationships but also enables identification of who has early dementia and needs special attention and assistance.

Table 7. Comparison Between the Sweet Family group and standard care support group regarding the **Diabetes Health Promotion Self-Care Scale (**5-point Likert scale**)**

variable	Sweet family	standard care support group	total	t	p value
Interpersonal relationship	24.53±3.35 n=68	21.94±3.68 n=79	23.14±3.75	4.437	<0.001***
Personal health responsibility	15.47±2.77 n=71	14.40±5.33 n=80	14.90±4.34	1.511	0.133
Diet	10.12±2.21 n=69	9.04±4.03 n=80	9.54±3.35	1.979	0.05*
Exercise	10.14±2.50 n=69	8.28±2.40 n=80	9.14±2.61	4.650	<0.001***
Foot care	10.20±2.62 n=70	8.25±1.80 n=80	9.16±2.42	5.364	<0.001***
Blood glucose self- monitoring	12.70±3.89 n=66	9.60±2.67 n=80	11.00±3.61	5.678	<0.001***
Adherence to the recommended regimens	12.16±2.19 n=61	11.32±2.03 n=76	11.69±2.74	2.347	0.02*

*p<.05; **p<.01; ***p<.001

Table 7-1: Linear regression of interpersonal relationship score

variable	B	S.E.	95% C.I.	p value
gender	0.529	0.667	-0.792-1.849	0.429
Family status	-0.046	0.389	-0.817-0.726	0.907
Living arrangement	0.888	0.932	-0.957-2.733	0.343
Educational level	0.616	0.206	0.207-1.024	0.03*
Volunteer activities	0.1638	0.441	0.764-2.512	<0.001***
Nurse-led diabetes health promotion education sessions	0.298	0.414	-0.522-2.118	0.473
F	7.892			
adjusted R^2	0.249			

*p<.05; **p<.01; ***p<.001

The interpersonal relationship score concerned spending time with intimate friends; finding ways to satisfy the needs of intimate relationships; keeping in touch and communicating with people about whom you are concerned; maintaining meaningful relationships with other people; expressing care, love, and warmth to others; praising the strength and virtues of other people; and resolving conflicts with others through discussion and negotiation. It was found to be significantly associated with educational level (B=0.616, 95% C.I.=0.764-2.512, p<.05), and participation in volunteer activities (B=0.1638, 95% C.I.=0.764-2.512, p<.001). These variables explain 24.9% of the variance in interpersonal relationships.

Table 7-2: Personal health responsibility

variable	B	S.E.	95%C.I.	P value
Educational level	0.300	0.258	-0.210-0.811	0.246
Tobacco use	2.981	1.166	0.672-5.290	0.120
Alcohol use	1.447	0.975	-0.484-3.378	0.141
Nurse-led diabetes health promotion education sessions	1.130	0.481	0.178-2.082	0.020*
F	4.755			
Adjusted R^2	0.107			

*p<.05; **p<.01; ***p<.001

The personal health responsibility score concerned discussing personal health issues with health care providers; reporting to health care providers any unusual signs or symptoms; discussing suggestions with healthcare providers when their advice is not clearly understood; consulting with health care providers about methods of practicing self-care. It was found to be significantly associated with nurse-led diabetes health promotion education sessions (B=1.130, 95% C.I.= 0.178-2.082, P<.05). These variables explain 10.7% of the variance in personal health responsibility.

Table 7-3: Exercise

variable	B	S.E.	95%C.I.	p value
Gender	-1.076	0.427	-1.921-0.231	0.013*
Volunteer activities	1.050	0.293	0.470-1.629	<0.001***
Nurse-led diabetes health promotion education sessions	0.576	0.279	0.024-1.129	0.041*
F	13.029			
adjusted R^2	0.212			

*p<.05; **p<.01; ***p<.001

The exercise score concerned keep exercising regularly, performing exercise despite feeling lazy, finding time to exercise even on busy days. It was found to be significantly associated with gender(B=-1.076, 95% C.I.= -1.921-0.231, P<.05), participation in volunteer activities(B=1.050, 95%C.I.=0.470-1.629, P<.001) and Nurse-led diabetes health promotion education sessions(B=0.576, 95% C.I.= 0.024-1.129, P<.05). These variables explain 21.2% of the variance in exercise.

Most of the volunteer organizations or sports teams in Taiwan that are involved in community activities comprise women. To encourage men to participate in community activities, one of the grading criteria for projects involving performing active aging dance shows in the

community each year is that the more men are involved, the higher the score is.

Table 7-4: Diet

variable	B	S.E.	95%C.I.	P value
Ethnicity	-0.528	0.345	-1.211-0.115	0.128
Educational level	0.176	0.129	-0.080-0.432	0.175
Familial Diabetes	-0.375	0.185	-0.742-0.007	0.046*
Tobacco use	-0.276	0.591	-1.447-0.896	0.642
Alcohol use	-0.604	0.501	-1.598-0.389	0.231
Nurse-led diabetes health promotion education sessions	0.612	0.224	0.129-1.096	0.013*
F	3.928			
adjusted R^2	0.119			

*p<.05; **p<.01; ***p<.001

The diet score concerned following the diet control rules for diabetes when having a meal outside the house or in an unfamiliar setting, follow the diet control rules for diabetes when having meals, and consistently substituting foods within the same category. It was found to be

significantly associated with familial diabetes (B=-0.375, 95% C.I.= -0.742-0.007, P<.05) and Nurse-led diabetes health promotion education sessions (B=0.612, 95% C.I.= 0.129-1.096, P<.05). These variables explain 11.9% of the variance in diet control.

Table 7-5: Foot care

variable	B	S.E.	95% C.I.	p
Gender	0.755	0.412	-0.060-1.570	0.069
Educational level	0.309	0.128	0.056-0.562	0.017**
Volunteer activities	0.345	0.285	-0.219-0.909	0.228
Nurse led DM health promotion education session	0.651	0.266	0.123-1.178	0.016**
F	6.758			
adjusted R^2	0.165			

*p<.05; **p<.01; ***p<.001

The foot care score concerned wearing appropriate shoes and socks when out or traveling, performing self-examination of feet according to suggestions of health care providers, and washing feet daily, drying feet, and applying ointment or foot cream. It was found to be

significantly associated with educational level (B=0.309, 95% C.I.= 0.056-0.562, P<.05) and nurse-led diabetes health promotion education sessions (B=0.651, 95% C.I.= 0.123-1.178, P<.05). These variables explain 16.5% of the variance in foot care.

Table 7-6: Blood glucose self-monitoring

variable	B	S.E.	95%C.I.	P value
Living arrangement	-0.777	0.906	-2.572-1.018	0.393
Educational level	0.196	0.205	-0.210-0.602	0.342
Volunteer activities	1.217	0.444	0.339-2.096	0.007**
occupation	0.592	0.430	-0.259-1.443	0.171
Tobacco use	0.824	0.913	-0.983-2.631	0.368
Nurse-led diabetes health promotion education sessions	0.650	0.416	-0.173-1.474	0.160
F	5.790			
adjusted R^2	0.146			

*p<.05; **p<.01; ***p<.001

The blood glucose self-monitoring score concerned measuring blood glucose in accordance with the suggestions of health care providers, increasing the frequency of testing blood glucose when feeling uncomfortable, writing down the results of each blood or urine glucose testing, and checking blood glucose as usual even when away from home. It was found to be significantly associated with volunteer activities (B=1.217, 95% C.I.= 0.339-2.096, P<.01). These variables

explain 14.6% of the variance in blood glucose self-monitoring. That is, volunteers should teach new members of the Sweet Family to learn to measure their own blood sugar.

Table 7-7: **Adherence to the recommended regimens**

variable	B	S.E.	95%C.I.	P value
Family status	0.206	0.288	-0.247-0.658	0.370
Living arrangement	0.332	0.535	-0.728-1.392	0.536
Educational level	0.155	0.122	-0.086-0.396	0.206
occupation	-0.515	0.248	-1.007- -0.022	0.041*
Nurse-led diabetes health promotion education sessions	0.518	0.217	0.089-0.948	0.018**
Numbers of hospitalization of DM	0.096	0.297	-0.494-0.685	0.748
F	2.448			
adjusted R^2	0.061			

*p<.05; **p<.01; ***p<.001

The adherence to the recommended regimens score concerned **t**aking diabetic medicine on time even when not at home, and taking medications at the prescribed times, taking prescribed doses of medication. It was found to be significantly associated with occupation (B=-0.515, 95% C.I.= -1.007- -0.022, P<.05) and nurse-led diabetes health promotion education sessions (B=0.518,

95% C.I.= 0.089-0.948, P<.05). These variables explain 6.1% of the variance in adherence to recommended regimens.

Table 8. Comparison between the Sweet family group and stand care support group with respect to the Perceived Therapeutic Efficacy Scale **(**0-10 point scale, from *no confidence* (0) *to highest confidence* (10)**)**

variable	Sweet family	standard care support group	total	Z	p value
My level of confidence in the ability of my diabetes medication to control my blood sugar is	8.16±1.56	7.70±1.75	7.91±1.67	-2.137	0.033*
My level of confidence in the ability that my diabetes medication can keep my blood sugar at a stable level and prevent it from becoming elevated is	8.24±1.80	7.75±1.70	7.98±1.76	-2.631	0.009**
My level of confidence in the ability of my diabetes medication to limit the severity of complications (e.g. eye or foot problem) is:	8.08±1.86	7.70±1.61	7.88±1.73	-2.546	0.011**
My level of	8.29±1.63	7.70±1.70	7.97±1.69	-2.624	0.009**

confidence in the ability of my diabetes medication to prevent me getting (more) complications is					
My level of confidence in the ability that the maintenance of the dose of my medication can control my diabetes effectively is	8.40±1.64	7.84±1.70	8.10±1.69	-2.468	0.014**
My level of confidence in the need to take my medication each day exactly as prescribed to control my diabetes is	8.37±1.688	7.89±1.70	8.11±1.71	-2.177	0.029*
My overall level of confidence in the value of the diabetes medication that I am prescribed is	8.22±1.80	7.96±1.67	8.08±1.73	-1.658	0.097
My level of confidence in the ability of medication in general to control my diabetes is	8.22±1.79	9.11±10.79	8.70±7.99	-2.147	0.032*

My level of confidence in my health professionals' advice that experts such as doctors or nutritionists and nurses give me in my diabetes treatment is	8.38±1.64	8.10±1.49	8.23±1.56	-1.697	0.090
My overall level of confidence in my ability to cope with my diabetes is	8.23±1.70	7.81±1.58	8.01±1.64	-2.490	0.013**
Perceived Therapeutic Efficacy Scale	82.57±15.95	79.55±19.51	80.95±17.95	-2.568	0.010**

*p<.05; **p<.01; ***p<.001

In Table 8 Both groups had 80% confidence in the medication of diabetes, because it is not the normal distribution, so use noparametric tests. The average score for level of confidence in the ability of diabetes medication to keep blood sugar at a stable level, to limit the severity of complications, prevent further complications score and for the maintenance of the dose of medication to control diabetes effectively score, overall level of confidence in ability to cope with diabetes, **and Perceived Therapeutic Efficacy Scale** were tested for statistically significant differences ($p < 0.01$) and are presented in Table 8. The standard support group exhibited less confidence for C-PTES**.** Therefore, professionals should tell patients in detail the role of

glycemic control drugs, usage and precautions, and confirm that patients understand, in order to enhance patient confidence in drug treatment. Some patients were worried about the impact of drugs on their kidneys and automatically reduced the drug, or even refused to take medicine unless experiencing discomfort, which affected blood sugar control. The regression analysis for the impact of treatment of diabetes efficacy, and the factors for age, family income level, and death and dying are shown in Table 8-1.

Table 8-1. Linear regression of Perceived Therapeutic Efficacy

Independent variable	B	SE	95%C.I.	p value
Sweet family Group	3.630	2.738	-1.790-9.051	0.187
Age	-0.359	0.134	-0.624—0.095	0.008**
Household income level	3.611	1.541	0.560-6.662	0.021*
Death and dying	-1.194	0.599	-2.381—0.008	0.049*
F	3.423			
adjusted R^2	0.130			

*p<.05; **p<.01; ***p<.001

There was no significant association between the C-PTES of the two groups. The regression analysis yielded a p-value of 0.817. However, they were found to be significantly associated with age (B = -0.359, 95% C.I.= -0.624—0.095, p<.01); household income level(B=3.611, 95% C.I.= 0.560-6.662, P<0.05); and death and dying (concern about the way you will die, fear of not being able to control death, fear of dying, fear of pain before death) (B= -1.194, 95% C.I.= -2.381—0.008, p<.05). These variables explain 13% of the variance in perceived therapeutic efficacy.

Table 9. Comparison between Sweet Family group and standard care support group with respect to **WHO QOL-Old**

variable	Sweet family	standard care support group	total	t	p value
Sensory abilities	10.06±1.92	10.58±2.09	10.33±2.02	1.561	0.121
Autonomy	15.34±2.88	14.05±2.62	14.66±2.81	-2.859	0.005**
Past ,present and future activities	15.20±1.91	13.73±2.91	14.42±2.04	-4.674	<0.001***
Social participation	15.05±2.04	13.12±226	14.14±2.40	-6.020	<0.001***
Death and dying	10.14±2.38	10.48±2.14	10.32±2.25	0.913	0.363
intimacy	14.16±2.93	13.10±2.53	13.60±2.77	-2.362	0.019*
Total	79.94±7.76	75.00±7.43	77.35±8.05	-3.840	<0.001***

*p<.05; **p<.01; ***p<.001

There were significant differences between the two groups as regards the quality of their elderly life (p <.001). The Sweet Family participants felt that they had autonomy (p <.005). (freedom to make their own decisions, positive perception of their future, feeling that people around them respect their freedom, ability to engaged in desired activities). Regarding past, present and future activities, the Sweet Family participants were more positive than the standard support group (p <.001) (satisfied with what they had achieved in life, received the recognition they deserve in life, satisfied with their opportunities to continue achieving, contented regarding anticipated future events). Participants in Sweet Family were more satisfied with the way they used their time, satisfied with their level of activity, felt they had enough to do each day, and were satisfied

with opportunity to participate in their community ($p<.001$). Regarding intimacy, Sweet Family participants felt that they received care from their partners, experienced more love, and had more opportunities to love others and be loved ($p = .019$). However, in terms of sensory ability (impairment of senses affecting daily life, loss of sensory abilities affecting participation in activities, problems with sensory functioning affecting their ability to interact, and rating of sensory functioning) and perception of death and dying, there was no difference between the two groups (Table 9).

Table 10. Linear regression for WHO QOL-Old

Independent variable	B	SE	95%C.I.	p value
Sweet family	0.105	1.307	-2.483-2.693	0.936
Living condition	3.780	1.675	0.463-7.097	0.026*
Participating community volunteer activities	2.344	0.851	0.659-4.030	0.007**
Interpersonal relationship	0.807	0.605	0.481-1.134	<0.001***
Regular exercise	0.759	0.240	0.285-1.234	0.002**
F	22.067			
adjusted R^2	0.477			

*p<.05; **p<.01; ***p<.001

As shown in Table 10, no significant association was revealed between the WHO QOL-OLD scores of the two groups, as the regression analysis produced a p-value of .936. The WHO QOL - OLD scores were found to be significantly associated with living conditions (B=3.780, 95% C.I.= 0.463-7.097, p<.05), participating in community volunteer activities (B=2.344, 95% C.I.= 0.659-4.030, p<.01), interpersonal relationships (B=0.807, 95% C.I.= 0.481-1.134, p<.001) and performing regular exercise (B=0.759, 95% C.I.= 0.285-1.234, p<.01). These variables explain 47.7% of the variance in WHO QOL-OLD.

Quality of life (QOL) is defined by the World Health Organization as individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.[72] These are embedded into intercultural contexts and living conditions, Sweet Family group through participating in

community volunteering activities (77.5%), better interpersonal relationships (24.53±3.35 vs. 21.94±3.68) and performing exercise more regularly (10.14±2.50 vs. 8.28±2.40), which improved QOL during the life course. Factors that promote self-care include: educational level, participation in volunteer activities, gender, occupation, familial diabetes, and nurse-led diabetes health promotion education sessions. At monthly Sweet Family meetings with diabetes educators, physician can help reduce diabetes complications, hospital admissions and maintain lower fasting blood sugar. These all contributes to a longer, healthier life.

Qualitative study data collection

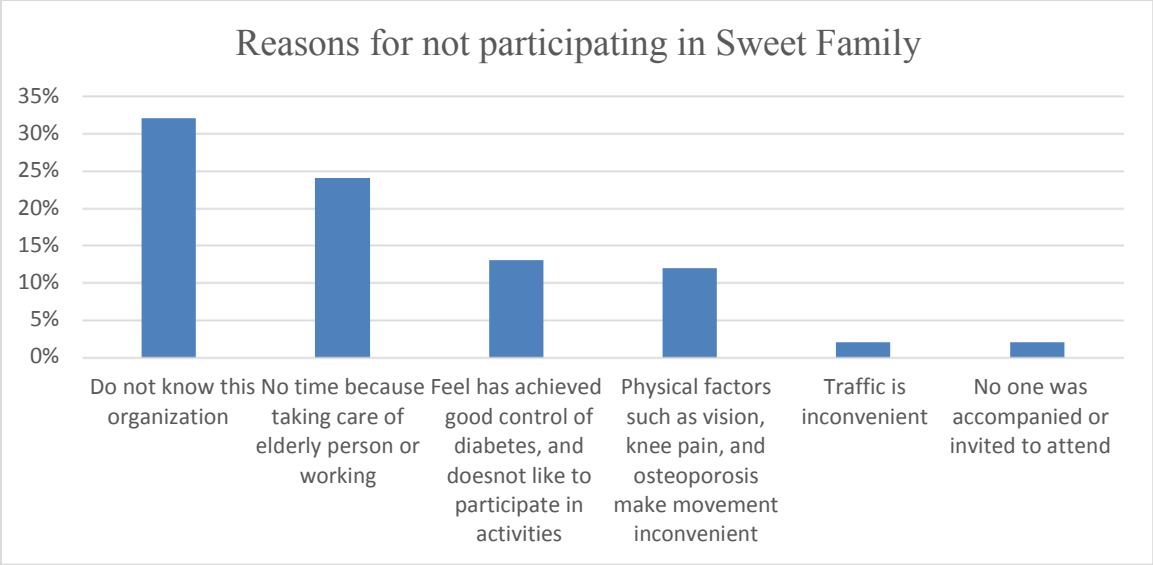
Qualitative methods were used to sample the interventions through the Sweet Family and standard care participants based on using key dimensions to ensure information rich cases that are typical of patients with T2D. Sampling was based on HbA1c levels and age of onset of diabetes, balancing male and female participants. All potential interviewees were contacted by phone to conform that they were willing to participate and were available for interview. Monthly focus groups were used to obtain the experiences of Sweet Family members living with diabetes. Groups ranged in size from five to seven individuals, and all information was recorded, transcribed, and analyzed using a thematic analysis approach.

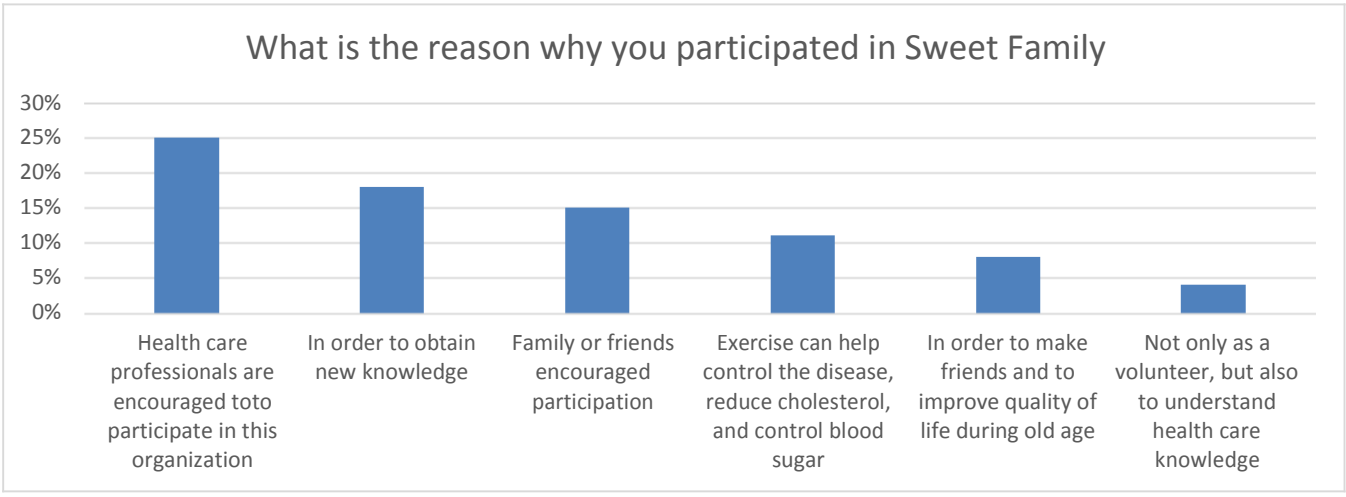
The purpose of qualitative analysis included discovering meaning, explaining meaning in the

patient's context, promoting understanding, raising awareness, and challenging misconceptions about the nature of human experiences. Interviews were guided through open-ended question exploring expectations, perceptions and experiences of receiving care intervention. Open-ended questions were also used to analyze multidisciplinary health care providers regarding diabetes care policies implemented in Taiwan, their experiences of diabetes care for elderly people, and their perspectives on its benefits and sustainability. To understand the barriers to diabetes management, we used interview guides and field notes to establish the expectations, perceptions and experiences of patients and health professionals who used or did not use the Sweet Family care intervention. The health of elderly people cannot be improved without changing their environment. It is imperative to involve patients in decision-making processes. Shared decision-making is a patient-centered approach in which patients and clinicians engage in dialogue to identify optimal practical courses of action while considering the patients' context. In shared decision-making, both patients and clinicians are considered experts. Clinicians are knowledgeable about disease and evidence, whereas patients are "experts" on how they experience the disease, their goals, and their expectations of medical care (Moreno et al., 2013).

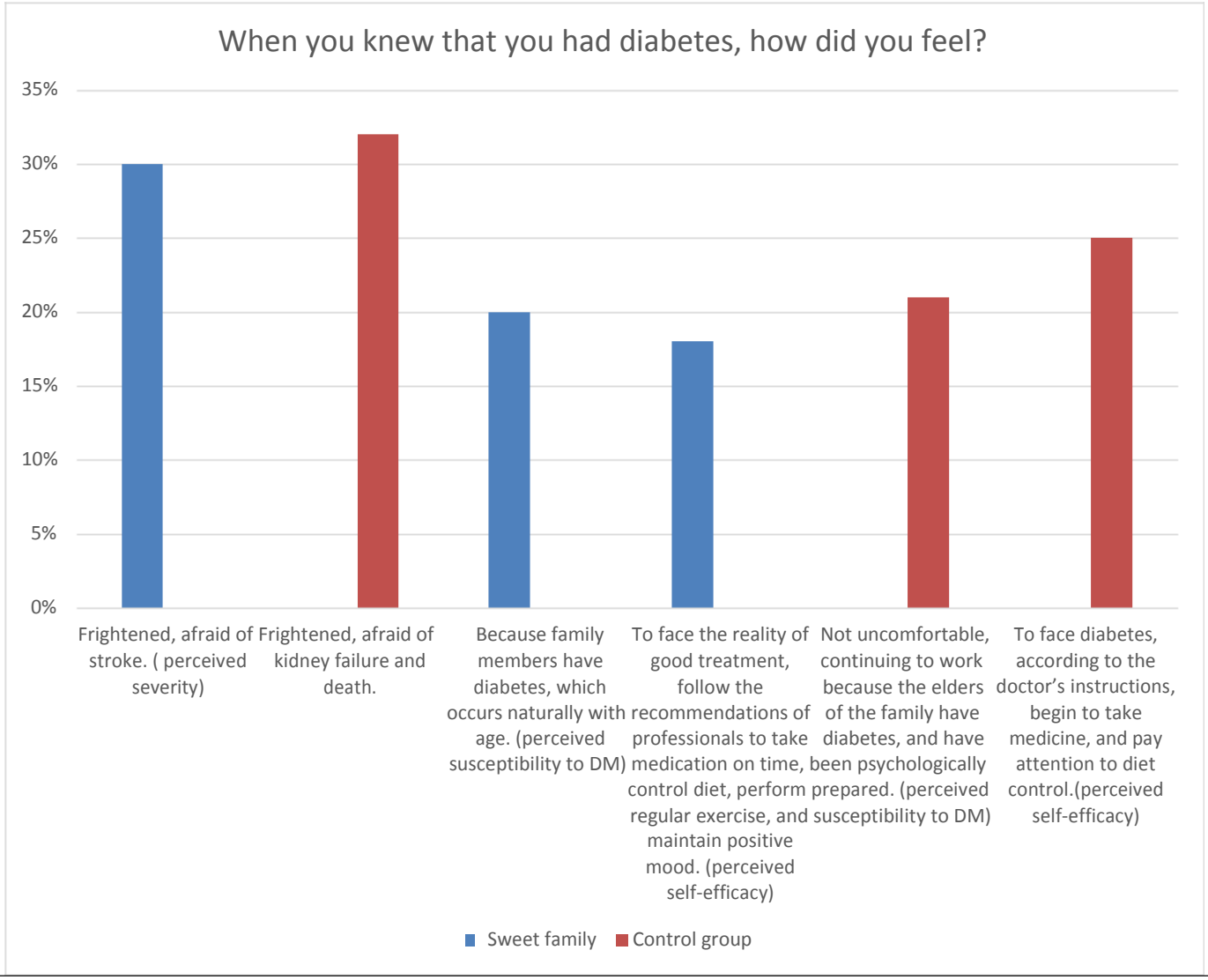
Results for qualitative analysis

What are the barriers to participating or not participating for DM patients?

What is your reason for not participating in Sweet Family"? (perceived barriers) Non-participants in Sweet Family: 84
1. Do not know this organization.（27/84=32%） 2. No time because of taking care of 93-year-old elderly person, and working.（20/84=24%） 3. Feel has achieved good control of diabetes, and does not like to participate in activities.（11/84=13%） 4. Physical factors such as vision, knee pain and osteoporosis make movement inconvenient.（10/84=12%） 5. Traffic is inconvenient.（2/84=2%） 6. No one was accompanied or invited to attend.（2/84=2%） 
What is the reason why you participated in Sweet Family? (perceived benefits) Participating in the Sweet Family: 71
1. Health care professionals are encouraged to participate in this organization.（18/71=25%） 2. In order to obtain new knowledge. (13/71=18%) 3. Family or friends encouraged participation.（11/71=15%） 4. Exercise can help control the disease, reduce cholesterol and control blood sugar.（8/71=11%） 5. In order to make friends and to improve quality of life during old age.（6/71=8%） 6. Not only as a volunteer, but also to understand health care knowledge.（3/71=4%）

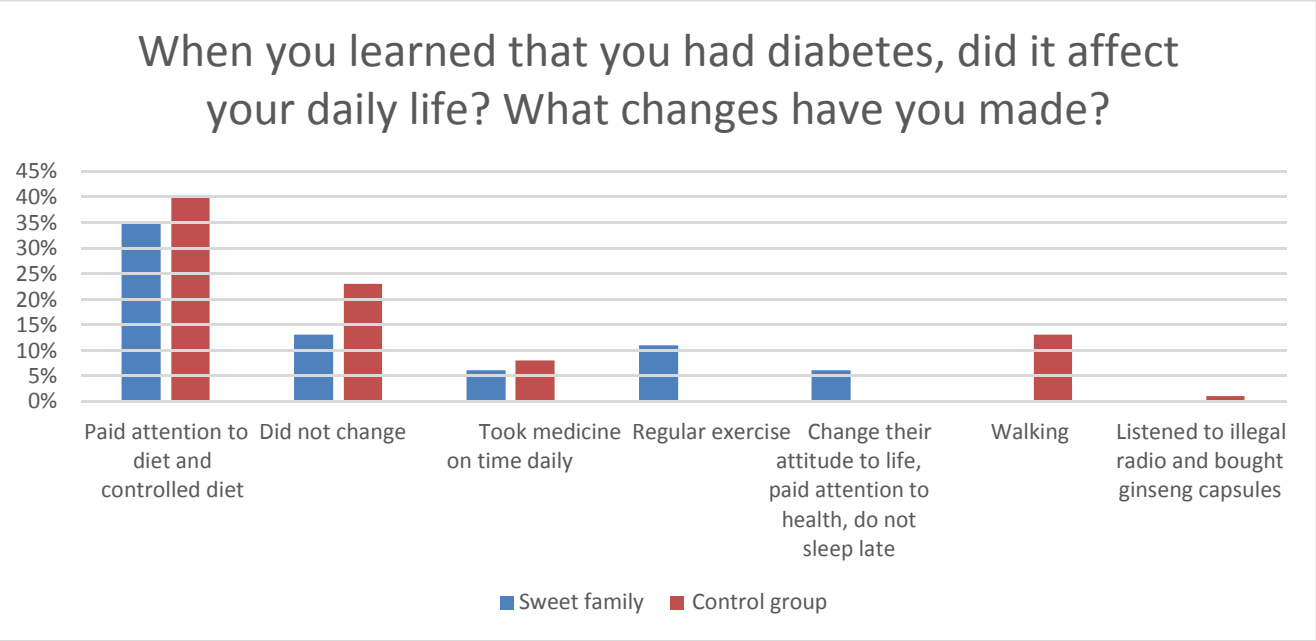


When you knew that you had diabetes, how did you feel?



Participants in Sweet Family clients: 71	Non-participants in Sweet Family: 84
1. Frightened, afraid of stroke. (perceived severity) (21/71=30%) 2. Because family members have diabetes, which2. occurs naturally with age. (perceived susceptibility to DM) (14/71=20%) 3. To face the reality of good treatment, follow the recommendations of professionals to take medication on time, control diet, perform regular exercise, and maintain positive mood. (perceived self-efficacy) (13/71=18%)	1. Frightened, afraid of kidney failure and death. (perceived severity) (27/84=32%) Not uncomfortable, continuing to work because the elders of the family have diabetes, and have been psychologically prepared. (perceived susceptibility to DM) (18/84=21%) 3. To face diabetes, according to the doctor's instructions, begin to take medicine, and pay attention to diet control.(perceived self-efficacy) (21/84=25%)

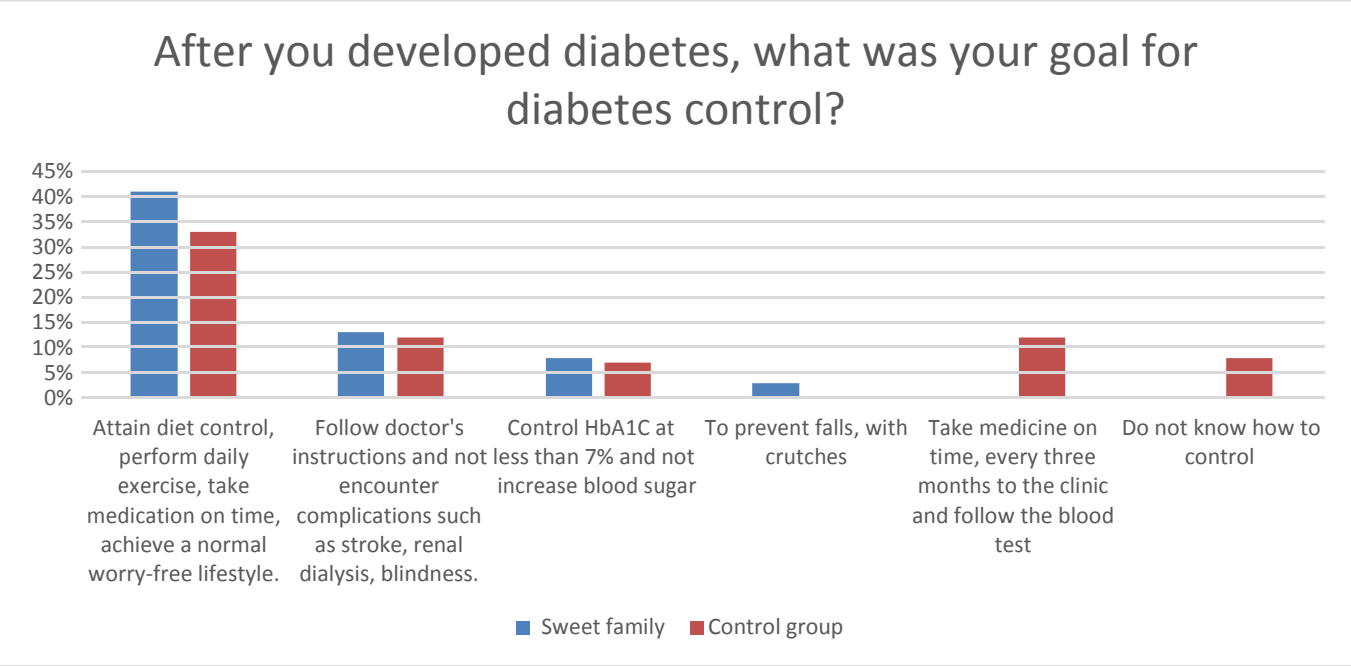
When you learned that you had diabetes, did it affect your daily life? What changes have you made?



Participants in Sweet Family: 71	Non- participants in Sweet Family: 84
1. Paid attention to diet and controlled diet. (25/71=35%) 2. Did not change (9/71=13%) 3. Regular exercise (8/71=11%) 4. Changed their attitude to life, paid attention to health, did not sleep late. (4/71=6%)	1. Paid attention to diet and controlled diet (34/84=40%) 2. Did not change. (19/84=23%) 3. Walking (11/84=13%) 4. Took medicine on time daily. (7/84=8%)

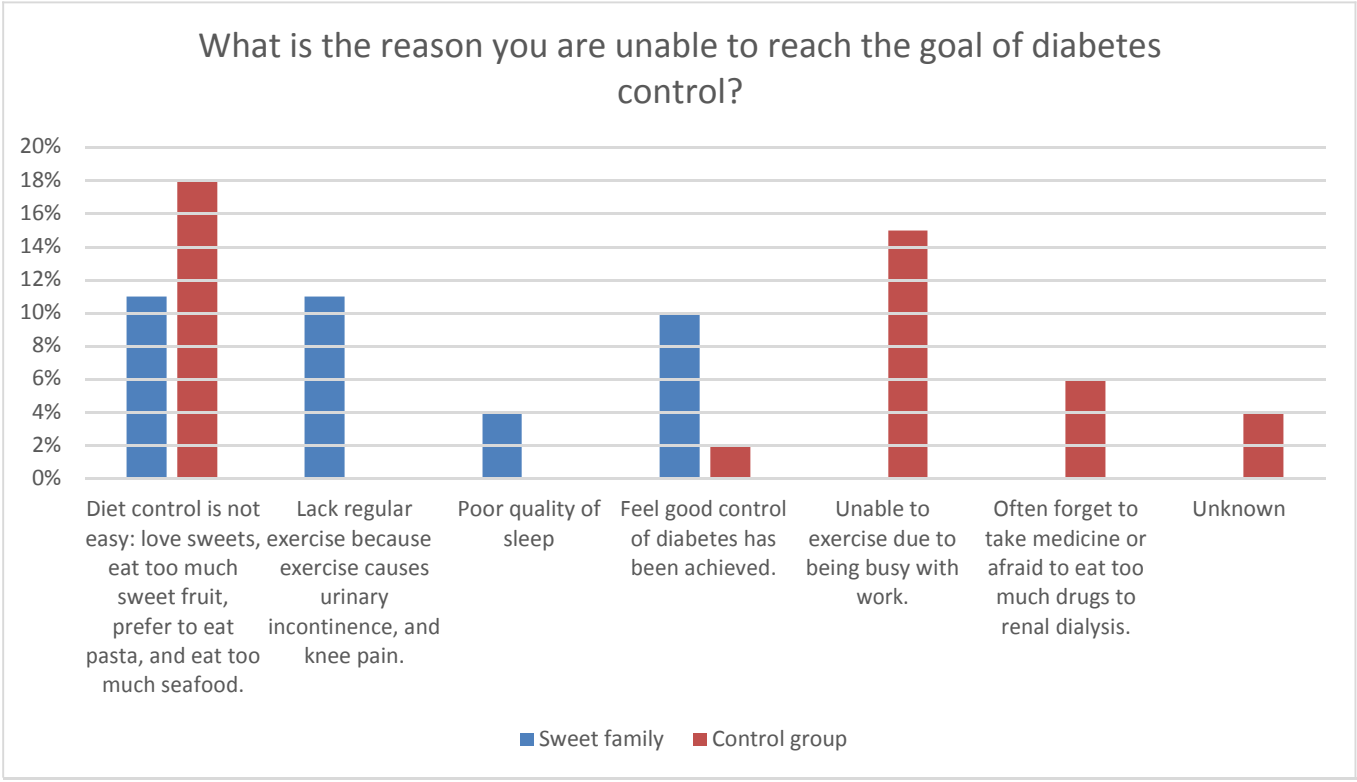
5. Took medicine on time daily.（4/71=6%）	. 5. Listened to illegal radio and bought ginseng capsules.（1/84=1%）

After you developed diabetes, what was your goal for diabetes control?



Participants in Sweet Family: 71	Non- participants in Sweet Family: 84
1. Attain diet control, perform daily exercise, take medication on time, achieve a normal worry-free lifestyle.（29/71=41%）	1. Attain diet control, eat more vegetables, increase daily walking, perform more exercise（28/84=33%）
2. Follow doctor’s instructions and not encounter complications such as stroke, renal dialysis, blindness.（9/71=13%）	2. Follow doctor’s instructions, and not encounter complications such as renal dialysis.（10/84=12%）
3. Control HbA1C at less than 7% and not increase blood sugar（6/71=8%）	3. Take medicine on time, every three months to the clinic and follow the blood test（10/84=12%）
4. To prevent falls, with crutches（2/71=3%）	4. Do not know how to control（7/84=8%）
	5. Control HbA1C at less than 7%（5/84=6%）

What is the reason you are unable to reach the goal of diabetes control ?



Participants in the Sweet Family :71	Non- participants in the Sweet Family: 84
1. Diet control is not easy: love sweets, eat too much sweet fruit, prefer to eat pasta, and eat too much seafood.（8/71=11%） 2. Lack regular exercise because exercise causes urinary incontinence, and knee pain.（8/71=11%） 3. Poor quality of sleep（3/71=4%） . 4. Feel good control of diabetes has been achieved.（7/71=10%） .	1. Diet control is not easy:. love sweets, and bread.（15/84=18%） 2. Unable to exercise due to being busy with work.（13/84=15%） 3. Often forget to take medicine or afraid to eat too much drugs to renal dialysis.（5/84=6%） 4. Emotional problems: become angry easily（3/84=4%） 5. Unknown.（3/84=4%） 6. Feel good control of diabetes has been achieved.（2/84=2%）

Person-centered care means respecting the patient as a unique individual, considering the patient's particularities and wishes and involving the patient in their own care (Arakelian,

Swenne, Lindberg, Rudolfsson, & von Vogelsang, 2017) The purpose of person centered care is to provide support that is attentive and tailored to patients' beliefs, values and preferences and to empower patients to improve and manage their own health, helping people live well with chronic conditions (Oftedal, Kolltveit, Zoffmann, Hornsten, & Graue, 2017; Zoffmann et al., 2016). Participants described their experiences of managing their diabetes daily, including being frightened to face it, following doctors instructions, starting taking medicine, and paying attention to diet control.

Perceived susceptibility to DM, involves family members having diabetes, and regarding diabetes as an process that occurs in conjunction with age. Perceived severity to DM, involves suffering stroke, kidney failure and death. The combination of susceptibility and severity has been labeled as perceived threat, and this perception leads to behavior changes that are influenced by a person's beliefs regarding the perceived benefits of the various available actions for reducing a disease threat. Participating in Sweet Family, not only as a volunteer, and, to make friends but also to gain health care knowledge and take regular exercise can help to control cholesterol and blood sugar, thereby improving the QOL of old age. It is necessary to identify the factors involved in not participating in Sweet Family and reduce perceived barriers such as not knowing the organization, unpleasantness, traffic inconvenience, and being time-consuming through community health professionals providing reassurance, correcting misinformation, and

providing incentives and assistance. Thus, “combined levels of susceptibility and severity provide the energy or force to act and the perception of benefits (minus barriers) provide a preferred path of action” (Rosenstock, 1997). For example, providing “how-to” information, promoting awareness, and using an appropriate remind system such as Line could be effective. Self-efficacy is defined as “the conviction that one can successfully execute the behavior required to produce the outcomes” (Bandura,1997). It is necessary to face the reality of effective treatment and follow the recommendations of professionals such take medication on time, control diet, and perform regular exercise to maintain a positive atmosphere at two groups. When participants developed diabetes, it affected their daily life and they were unable to reach

the goal of diabetes control, encountering difficulties with their diet and implementing extensive dietary change, as required by dietician guidelines. Of the nonparticipants in Sweet Family 22% （19/84）did not change their life style, compared with 12% (9/71）of Sweet Family participants. Listening to illegal radio and buying ginseng capsules indicated older age and lower educational attainment affecting health literacy. Buying drugs or health supplements with unknown effects that cause kidney damage necessitating renal dialysis is a common phenomenon in Taiwan that is encountered in long-term care facility. Once the initial shock and distress of diagnosis reduced, most participants reached acceptance, changing their attitude to life, paying attention to health and not sleeping late. The experiences of managing their diabetes was

physically, emotionally and socially challenging. It is important for healthcare professionals and family members to recognize the emotional burden and to encourage participation in Sweet Family. Nurse-led diabetes health promotion education sessions occur once a month, and participants not only absorb new knowledge but also asks questions of experts, and sports experts guide them in aerobic and stretching for one hour. In addition, daily dietary records are collected, followed by dietician assessment, guiding participants in how to eat properly. This includes whether they are not eating enough vegetables, eating too much fruit or carbohydrate, and being guided to make adjustments. The main objective of peer support interventions is to provide support based on the sharing of information and experience, mutual counseling and exchange among "peers" (Whitford, Paul, & Smith, 2013). Woodcock and Gillam (2013) explored how older people with diabetes wish to be involved in their care. Healthcare providers should regularly assess patients' knowledge in order to resolve potentially harmful misunderstandings. It is important to consider levels of health literacy in the community when developing diabetes-related information or programs (Woodcock & Gillam, 2013).

Community healthcare providers (six primary medical clinic physicians, five community pharmacists, six community physical exercise counselors, six diabetes educators, and four dieticians) were interviewed and the transcripts of the interviews were confirmed by the interviewers. Key themes and concepts were identified using framework analysis.

What causes diabetes mortality in the Keelung area to be higher than the national average?
Primary medical clinic physician：6

1. Noncompliance, due to fear of the side effects of drugs, fear of kidney damage and not willing to take medicine; younger cases are due to being busy with work and forgetting to take medicine (5/6=83%).
2. Low education levels result in lack of understanding of the complications of diabetes. It is necessary to strengthen the integration of institutions across the medical system, starting with source control. Only cooperation and appropriate referral can extend the life span of diabetes patients and improve their QOL. (4/6=67%)
3. Most residents of Keelung are laborers. Their work is demanding, and there is a shortage of leisurely parks. The atmosphere of the community is negative, and the suicide rate is high. This also affects control of chronic diseases. (4/6=67%)
4. The increase in the proportion of the elderly population in the Keelung area is consistent with the growth rate of the number of people with diabetes. Elderly people live alone, with very limited family support, and mostly eat at restaurants for breakfast, lunch and dinner (3/6=50%)
5. Primary care physicians are too conservative in prescribing medication. Insulin can be used early (2/6=33%)

   ..
6. When goals for patients' blood glucose control can't be achieved, primary physicians recommend that patients subcutaneously inject insulin. Many diabetes is not accepted, they believe insulin causes complications. (3/6=50%)
7. Diabetes is difficult to self-manage, in the context of frequent food programs being broadcast on TV. Keelung is a harbor, with numerous sea food products, and traditional foods tend to be excessively salty and sweet, causing obesity (3/6=50%)
8. Age is not a disease. Ensuring that elderly people feel that treatment of their diabetes will have positive outcomes should result in their continuing to follow their doctor's advice, practice good self-management, take moderate regular exercise, follow diet and drug guidance, and improve regarding numbness and weakness. In addition, addressing symptoms of obesity and dizziness is important to ensure that patients follow guidance (3/6=50%)

   .

9. Retired patients and their families should be encouraged to participate in Sweet Family to share the experience of disease management and develop good interpersonal relationships. The future Sweet Family can provide two traffic vehicles with the aim of helping the diabetic community to participate in monthly of activities and sharing, thereby enhancing the control of diabetes (3/6=50%)

What is the problem most commonly encountered by community pharmacies regarding diabetes? Community pharmacist:5

1. Compliance with the doctor is inadequate; lack of knowledge of drugs; not taking medicine on time; increasing or decreasing doses (5/5)。
2. Diabetes patients in the Keelung area use oral medication first and do not like to inject insulin. This can be very serious when injection of insulin injections (5/5)
   .
3. Family screening has been implemented in Keelung since the beginning of 2011 and has identified more diabetics, HbA1C control is poor because diet control is challenging. Probably only 1% to 2% of patients follow the instructions of their dietitian effectively. Most patients control their diet a week prior to examination in order to obtain blood results to deceive themselves and their doctors. so Blood sugar is thus poorly controlled (3/5)
4. Keelung has a high proportion of elderly living alone. Elderly patients with diabetes often can not distinguish between daytime and nighttime medication, have poor memory, and often forget or repeat their medication (2/5)
5. Fear of humiliation due to developing diabetes often affects obtaining treatment (2/5)
6. Diabetes patients do not understand the importance of physical exercise, regarding housekeeping as a substitute,despite its being insufficient exercise (2/5)
   .
7. Community pharmacists play a role in reviewing chronic prescriptions, whether repeat medication has occurred, and provide instruction on how to use the medication (1/5)
   .

1. Diabetes occurs because of poor physical metabolism. Elderly people are often tired, do not want to move, are often depressed, and do not want to study, finding self-training, self-motivation, and

behavioral changes challenging. Unless diabetes patients are self-aware regarding their diseases, promoting motivation to exercise among elderly people is most important.（4/6）

2. To teach elderly people about movement, we must first understand their exercise habits and physical condition in order to design an individual schedule. It is usually necessary stretch to warm up before exercise and stretch after, and to pay attention to hydration and avoid low blood sugar. Morning exercise, afternoon relaxation, and nighttime rest are necessary, to help elders to adapt more effectively.（3/6）

3. Elderly people should be encouraged to do more stretching exercises. As long as the movement is performed after a period of time, they can effectively control blood sugar and blood pressure, and will be willing to exercise（3/6）

4. It is necessary to remind elderly people of the need to exercise, to wear suitable shoes and socks, pay attention to lower extremity circulation and warmth, protect themselves from injury, wear safe sports designs, and engage in simple and interesting activity. They should always check their feet for sores or blisters before and after exercise（3/6）

5. Taking time to establish a trusting relationship affects sports engagement among elderly people. We guide activities so that students feel that class is interesting and are not interrupted（3/6）

6. Regarding self-management, for elderly people with poor memory, we do not force self-exercise, and we cooperate with primary physicians. If a physician explained the benefits of the movement, community members more readily accept his to be true.（2/6）

7. We hope that the people engage in regular exercise to promote health, and reduce medical expenses and waste of medical resources.（1/6）

What do you think is the most difficult aspect of diabetes self-management in daily life ?
Diabetes educators：6

1. Diabetes patients do not sufficiently understand the disease. However, if they are motivated to change their lifestyle, we can deliver patient-centered health information and clear explanations.（5/6）
2. New cases can receive explanations about basic diet, exercise and related health education such as whether wounds (limbs) exhibit slower healing and teaching wound care methods. Patients can be

encouraged to wear shoes, not wear sandals with exposed toes, and be taught how to trim their fingernails and toenails. However, because some old people have poor hearing, communication is not easy.（2/6）

3. Denial about diabetes can occur because the symptoms are not obvious. Consequently, patients do not experience a sense of crisis.（3/6）

4. Keelung is a harbor, and the area mostly comprises hillside. Residents typically eat seafood and favor salty, fried food.（3/6）

5. Changing eating habits is not easy. Many elderly patients can not accept the need for long-term diet control, lack the concept of eating food from a single plate, and use chopsticks to take foods, which causes excessive consumption.（2/6）

6. Education level and socioeconomic status influence on the self-management of DM. Those with lower education levels, lower health literacy, and challenges to comprehension are more passive in the treatment of the disease. They think that taking medicine can control diabetes and are less motivated to seek other assistance. People with high socio-economic status, favorable economic conditions, and more time can attend nurse-led clinics and thereby establish therapeutic relationships, and assistance in self-care management. For example, they can arrange time for exercise and fitness training, participate in Sweet Family, attend participate in disease-related lectures and read books.（2/6）

7. The current environment is harsh, and living conditions are constrained. For some patients, three meals a day are not easy to eat, and they have not capacity to attend to disease management. For patients to cooperate by attending a blood test and treatment every three months is already very valuable（1/6）

8. The concept of prevention, which involves identifying the causes of diabetes, establishing the concept of risk, and implementing school education, so that people develop a balanced diet from childhood, take regular exercise habits and undergo health screening is better than disease treatment that wastes medical resources（2/6）

9. In Keelung, elderly people live alone, due to lack of family support. It is necessary to use patient groups to strengthen health promotion.（2/6）

10. Diabetics should be encouraged to record daily diets and provide nutritionists can provide individual guidance.（2/6）

What are the difficulties in guiding diabetes diet control?
Dietician: 4

1. The majority of elderly diabetics have diet poor control. The main reason is that they do not comprehend the disease and do not think to control their diet.（3/4）

2. It is necessary to implement person- oriented diet designs centered on patient needs.（3/4）

3. It is necessary to discuss with diabetic patients and their main caregivers, that in the case of patients with old habits and psychological challenges, they can not impose too many estrictions. After discussing slight adjustments, patients will accept increased diet control.（3/4）
   .
4. To strengthen daily diet records, weight concepts should be introduced such as a bowl of rice is four servings carbohydrates, one serving is equal 15 grams of sugar, a meal includes 45-60 grams of carbohydrate; a servings fruit is the size of a fist, and a large palm is 3 servings of protein. Vegetables can be eaten in as great a quantity as is desired.（2/4）

5. Community food service can help the elderly to achieve a sufficiently balanced diet, including protein, vegetables, and fruit. The principle is simple, namely consuming easy to chew, easy to swallow, non-toxic clean food.（2/4）

Discussion

The medical problems experienced by diabetics have numerous aspects, requiring management by multiple health care professions. Based on the quantitative and qualitative data obtained in this study, maintenance can be re-conceptualized to include both integration of an intervention into routine practice and integration of a limited number of program components that may improve patient care for example, increasing compliance of patients with diabetes. Factors that promote self-care include client's educational level, participation in volunteer activities, gender, occupation, familial diabetes, and nurse-led diabetes health promotion education sessions. Perceived therapeutic efficacy is associated with age, household income level, and death and dying. Health care professionals in Keelung are encouraging patients with diabetes to join Sweet Family.

The aim of this study was to explore the experiences and concerns of individuals with T2DM, in a predominantly low socio-economic community setting in Taiwan. In this study, a considerable level of interaction was evident as Sweet Family participants completed each other's comments and asked questions of each other. A topic raised by one participant could be clarified by another participant, for example, how to change recipes, by steaming fish or vegetables instead of frying them in order to achieve the low salt, oil and sugar targets or provisions of diabetes-related information (each Sweet Family members is obliged to provide

blood glucose readings and test strips results, and daily blood glucose and dietary records must be completed.).

Older people with diabetes wish to be involved in their care. Healthcare providers should regularly assess patients' knowledge in order to resolve potentially harmful misunderstandings. Explanations should be detailed and repeated, and sources of information need to be appropriately user-friendly for this age group. Nurse-led care with thorough continuity was highly acceptable (Woodcock & Gillam, 2013). 30.4% of Sweet Family participants and 69.6% of standard care support participants experienced peripheral neuropathy complications such that foot self-care behaviors were viewed as part of their daily routine. Assessment of peripheral neuropathy was conducted in a clinical setting in Taiwan. Lee et al. (2017) explored the usability (ease of use) and utility (impact on user's decision-making process) of the web-based patient decision aid "Should I Start Insulin" among older (median age 65 years) patients with T2DM in Malaysia. They found participants played a part in the decision-making process, however, most participants were better educated, and had some degree of computer literacy (Y. K. Lee et al., 2018). In Taiwan, when HbA1c exceeds 7%, insulin therapy may be considered. Rodbard (2017) found that continuous glucose monitoring (CGM) could help reduce HbA1c and mean glucose improving patient QOL and clinical indications. Most physicians have not been trained in the interpretation of CGM data or use of those data for generating recommendations for revision of

therapy, diet, or lifestyle. Guidelines for physicians are necessary, such as to when to deploy these new systems for control of insulin administration (Rodbard, 2017).

The Lancet (2017) released data on the Healthcare Access and Quality(HAQ) Index, which is based on mortality from causes amenable to personal health care in 195 countries and territories from 1990 to 2015, as determined through and involved a novel analysis based on the Global Burden of Disease Study, 2015Taiwan's overall ranking is 45. Its level for the HAQ Index is 78, that for Diabetes mellitus is 58, and that for Chronic kidney disease is 50, amenable age range are 0-49 years for DM, and 0-74 years for Chronic kidney disease ("Healthcare Access and Quality Index based on mortality from causes amenable to personal health care in 195 countries and territories, 1990-2015: a novel analysis from the Global Burden of Disease Study 2015," 2017). Exposure to risk factors such as diet, high BMI, Blood Pressure and physical activity, can be detected early in the health system. Thus, improving personal health-care access and quality is an important priority in Taiwan. However, Chen et al. (2017) provided evidence of a rural-urban disparity in receiving essential care such as HbA1c, lipid profile, and eye examinations, which diminished between 2000 and 2010; however, the rural-urban gap in the likelihood of avoidable hospitalizations for diabetes persisted (C. C. Chen, Chen, & Cheng, 2017). Rural residents are more likely to experience barriers to receiving diabetes education programs that support diabetes patients' engagement in self-care (Brown-Guion, Youngerman,

Hernandez-Tejada, Dismuke, & Egede, 2013). Disparities exist in clinical practice with regard to the treatment of diabetes, requiring continuing medical education to enhance adherence to clinical guidelines and promote diabetes care, thereby improving patients' health literacy and adherence to physicians suggestions through self-care programs (C. C. Chen et al., 2017). Keelung area diabetes patients initially use oral medication and do not like to inject insulin, due to a myth that injecting insulin indicates a critical situation. Community pharmacists play a role in reviewing chronic prescriptions, identifying repeated medication, and teaching how to use medication.

Sagner et al. (2017) proposed the Predictive, Preventive, Personalized and Participatory Health Continuum model as a framework for promoting and facilitating multi-stakeholder collaboration with an orchestrated common language and an integrated care model to increase health spans (Sagner et al., 2017). Carolan (2014) studied T2D experiences in Australians, describing how diabetes is silent disease that usually progresses slowly, involving a personal journey, in which early disease precursors and dysfunctions can be detected, for example: feel numbness and weakness in hands and feet, as well as blurred vision. However, individuals can be unaware of symptoms or not recognize their symptoms, which is common in clinical medicine, where traditional reactive health care is initiated, and the work of managing diabetes involves access to resources and services. However, intervention and lifestyle management at early stages

has the potential to reverse the disease process, preventing permanent damage and dysfunctions, such as myocardial infarction or stroke (Carolan, Holman, & Ferrari, 2015; Sagner et al., 2017). However, it is important for health care professionals and family members to recognize the significant emotional burden that diabetes imposes, providing support and encouragement to assist self-management efforts. Whitworth et al. (2016) conducted The Fremantle Diabetes Study, identifying how lifetime depression and anxiety increase the risk of more severe psychological symptoms, hyperglycemia, and difficulties with health behavior such as smoking and reduced self-monitoring of blood glucose. Early screening for these disorders can maximize long-term health outcomes (Whitworth et al., 2016).

Keelung physical exercise counselors encourage elderly people to do more stretching exercises and walking, which translates into more vitality and a greater sense of well-being, reducing their stress. Provided regular exercise can help build stronger muscles, participants can effectively control blood sugar and blood pressure, and will be willing to exercise. Dieticians ensure diet designs are centered on patient needs. This can involve discussions with the diabetic patients and their main caregivers, recognizing that patients may have long established habits and problematic, psychology, and thus not imposing too many restrictions on sugar. Sweets have important emotional and cultural benefits in our society, and sugar is a carbohydrate that can be included as part of a healthy, diabetes- friendly diet. After discussion a slight adjustment can be

made, and patients can accept a higher diet control.

As we continue to develop and refine our patient-centered medical care model, priorities need to be divided up among the members of the team. Patients should be called back, and their prescriptions refilled. Nurse-led diabetes health promotion education sessions can lead to better care and more satisfied patients. Vogt et al. (2017), argued that health literacy is important for older people to maintain or enhance remaining health resources and self-management skills; financial deprivation is the strongest predictor for limited health literacy in all older adults (Vogt, Schaeffer, Messer, Berens, & Hurrelmann, 2017). The concept of health literacy is defined as an individual's abilities and skills to gain, understand and use health information in order to make judgments and take decisions in everyday life, thereby maintaining or improving their QOL during their life course (Sorensen et al., 2012). However, health literacy declines with increasing age among adults with diabetes. Individual variability in health literacy has implications for the best timing and approach to providing self-management education and support (Morris, Maclean, & Littenberg, 2013). Functional health literacy leads to improved knowledge of risks and health services, and compliance with prescribed actions, increases participation in public health programs(Sorensen et al., 2012).

People living with diabetes need tailored advice. Nurse-led diabetes health promotion education sessions involving a certified diabetes educator can offers a wealth of advice and

resources for diabetes management. All diabetics should visit a diabetes educator. However, 34.4% of participants in the present study did not attend education sessions. It is necessary to focus on individuals' complex self-management behaviors such as diet, physical activity, blood glucose monitoring, and how they are responding to medication, and stress in order to achieve metabolic control and prevent long-term complications ("Standards of Medical Care in Diabetes-2016: Summary of Revisions," 2016) [87]. The International Diabetes Foundation (IDF) argued that without effective patient counseling methods in diabetes care, the burden of living with the disease will continue to increase (IDF, 2015) [87]. The World Health Organization (WHO, 2013) emphasized the importance of person-centered care (PCC) for promoting better health outcomes and improving well-being. This involves understanding patients as equal partners in planning, developing, and assessing care rather than focusing on the disease (D., 2014). PCC is structured around consultations in which health professionals use counseling methods to activate and motivate patients to become partners in healthcare decisions (Coulter et al., 2015). Diabetes self-management is an interactive process in which "Both educators and patients are experts. Educators have the expertise in a specific context and the clinical aspects of the disease. However, patients are the experts in their own life." Whitford et al. (2013), trialed a series of patient generated frequently asked question and answers to address the information needs of people with T2DM, and found that patients were very satisfied with this approach, because the

peer discussion of both generated questions in the peer support group and the questions answered by the professional team were a means of enabling health information to become accessible to all participants- regardless of age, educational level or literacy (Whitford et al., 2013). However, it is important to consider levels of health literacy in the community when developing diabetes-related information or programs (Carolan et al., 2015).

Healthy behaviors are thought to be maximized when environments and policies support healthful choices, and individuals are motivated and educated to make those choices (K. R. Glanz, B. K.; Viswanath, K. , 2008). In Keelung, Sweet Family employs an ecological perspective in which the long-term success of self-management depends on the contexts that surround the individual. Several approaches to providing follow-up and support can be used, including phone calls with nurses and contacts with community health workers, Chi-Du community health center expanded group medical visits to a monthly open group that included dieticians providing cooking demonstrations (or evaluating daily diet records), physical activities, group support, opportunities to ask questions of health care staff. According to Dehkordi et al. (2017), ongoing follow-up and support for good self-management are among the effective and recommended components of diabetes self-management, requiring assessment, interactive teaching methods, a multidisciplinary approach, technology and appropriate physical space need to be considered to improve diabetes self-management education (Mardanian

Dehkordi & Abdoli, 2017). Providing individuals with motivation and skills to change behavior should create environments and policies that make it convenient, attractive, and economical to make healthful choices, and then motivate and educate people about those choices. Keelung Municipal Government Health Bureau provides eye examinations and Flu shots each year on World Diabetes Day in November.

Conclusions and Suggestions

Family structures in Taiwan have rapidly changed. The average number of family members dropped to 2.77 in 2015. According to a survey on the living conditions of elderly people in 2013, 63.3% of elderly people having difficulties in their daily living activities are looked after by their families at home. However, the number of their future families continues to decrease with fewer children. With the increasing participation of women in work, the family care function is weakened. However, Taiwan has a high standard of health insurance system. Therefore, when diabetes is diagnosed, efforts must be made to avoid disability and self-health management should be established. Simultaneously, a comprehensive long-term care system, can provide home-based, community-based and institutional types of long-term care services. A study revealed that the universal coverage system in Taiwan did not eliminate the rural-urban differences in healthcare outcomes among patients with diabetes. This study found that the rural-urban disparity in receiving essential care diminished between 2000 and 2010; however, the rural-urban gap in the likelihood of avoidable hospitalizations for diabetes persisted, and rural patients were more likely than urban patients to be hospitalized due to DM (C. C. Chen et al., 2017).

This study focused on the Chi-Du primary care team enrollment in the DSCP and compared participants in Sweet Family with non-participants. It found that participants in Sweet Family

with DM lived 5 years longer had fewer complications, and were hospitalized for shorter periods; their control of diabetes and QOL better than non-participants. In Taiwan, the National Health Insurance Administration has implemented P4P since 2001, and this program provides financial incentives to healthcare providers according to the delivery of proper follow-up care or the attainment of specific predetermined quality benchmarks such as HbA1c, lipid profile, and eye examinations. The findings may be due to Sweet Family following a community-based integrated service model, which places more emphasis on personal health management, following instructions on health education, and improving self-efficacy.

The Sweet Family approach encourages patients to participate by discussing concerns and beliefs, and provides suggestions for how to talk with their physicians. For example, patients are encouraged to return to the clinic every 3 months to ask three questions: What is my main problem? What do I need to do? Why is it important for me to do this? This study provides evidence for recommended care, with no disparity in receiving essential diabetes education programs that support patients' engagement in self-care. Therefore, we recommend improving patients' health literacy and their level of adherence to physicians' suggestions through self-care programs. Keelung elderly people living alone, and lack family support, so patient groups can be used to strengthen health promotion.

Health-systems enable risks to be detected early. Improving personal health-care access and

quality is an important priority in Taiwan. We recommend strengthening family, school and workplace education awareness of healthy eating, reducing the intake of junk food and sugar, paying attention to weight control, and developing exercise habits from an early age, so that people develop a balanced diet from childhood. Establishing regular exercise habits and health screening prevention concepts is better than disease treatment involving the waste of medical resources.

Interviews with community care professionals, clarified the need for patients to improve their drug compliance and their perception of the importance of diet and exercise. They recommended using easy to understand information to improve patient communication; avoiding professional language; and teaching diet, exercise and medication. It is necessary to check blood glucose or insulin subcutaneous injection and focus on demonstration teaching and patient participation to confirm that patients or family members understand. Health professionals must strengthen communication with elderly people, especially regarding vision and hearing specifically, they must speak with elderly people face to face with a clear, slow pitch, so that the elderly people can see the mouth shape and clearly. For example, community dietitian one-on-one guides can involve, first understanding the patient's eating habits, and making small adjustments. In the case of individual, requirements in which elderly participants cannot accept limitations being imposed on their diet, teaching, the concept of serving weight is more

acceptable. When patients have just been diagnosed with diabetes, establishing partnerships and the trust of the treatment staff can help establish self-health management that leads to better metabolic control.

The fundamental premise of Sweet Family is love, because by loving each other and caring about each other, professionals, patients and their families can work together to control their blood sugar, reduce complications, and live a healthy and happy life. Keelung Chi-Du primary care group, Dr. Ji's Clinic visits remote mountain areas twice per month to solve the problem of traffic difficulties faced by rural residents. Sweet Family meets on the third Saturday morning of every month. Feelings of love can inspire the group's cohesion and solidarity. Members of Sweet Family share a consensus on their health goals, reminding, supporting, and encouraging each other in a spirit of self-help and mutual assistance, and emphasizing the message "I am responsible for my health", Sweet Family is a learning organization that must enable members to experience change in their health behaviors when they develop self-responsibility; they must commit themselves to helping each other and to a healthy life. This is achieved through events such as sports activities led by teachers at Chi-Du health center on Monday, Wednesday and Friday from 9 to 10 am, with sports partners to help restore confidence and love of life. In addition, preventive health services such as flu shots and cancer screenings can help to create a happy old age. The results of this evaluation of Sweet Family emphasize the causal relationship

between process and result, namely that correct processes can yield good results. Active aging and Aging in Place are the important directions for long term care policy, creating an integrated project for all elderly people, that promotes health literacy strategies worthy of consideration by health authorities.

Limitations and Strengths

We included both qualitative and quantitative studies in the present study. The strengths of this study are as follows. Data were obtained from a faith community; The primary physician who initiated the diabetes club (Sweet Family) in 2014 and the nutritionist who designed a program to teach the basics of eating a balanced diet were invited to participate as well as an identified organization, health care provider, and community resources from the geographic area. The diabetes care management system was developed as a comprehensive population-based disease management system in Taiwan. Furthermore, it included provider education programs, P4P patient education programs, patient incentives, reminder systems for encouraging compliance with the most appropriate care process model, and tracking of physician behavior change and patient compliance with diabetes therapy.

The limitations are the Chi-Du district database, which used retrospective data collection and the cross-sectional descriptive study that was conducted by comparing the effectiveness of the multidisciplinary, community resource-based, integrated primary- secondary care diabetes Sweet Family group service with a standard care support group, the participants of which did not attend the Sweet Family group. It used neither a control group nor random assignment, quasi-experimental designs that either lack a control group or that lack pretest observations on the outcome; practical necessities imposed by administrators; constraints that occur when an

intervention has already been fielded before the evaluation of that intervention is designed. Otherwise, willing to join the sweet family, usually more willing to take the initiative to participate in community activities, a higher level of education, making the causal inference of this study is relatively weak.

The sample size of the Sweet Family group database provided a favorable opportunity to study high quality care that has improved QOL. However, this is a retrospective cohort study. We cannot exclude the presence of undetected bias. Moreover, some potential confounders, such as personal and environmental factors and other secondary prevention regimens, were not assessed. Therefore, we attempted to minimize the selection bias by adjusting all obtainable demographic and comorbidities; however, some unmeasured confounding factors cannot be completely ruled out.

Human Participants

This is a retrospective and cross-sectional descriptive study. All participants provided written informed consent prior to participation. Moreover, this study will be sent to the Institutional Review Board of Johns Hopkins University for approval.

Curriculum Vitae

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SUMMARY:

I was born in Taiwan on May 6, 1950. Devoted RN with 31 years of clinical experience within medical-surgical settings as well as 15 years of professional instruction experience at a nursing college. Provide services in both Taipei metropolitan area and overseas. Proficient at assessment and continuing care. Outstanding presentation and communication skills. Improving access to care by empower health education program. We conducted intervention at Chi-Du community health center, which engagement top priority is to address and eliminate the health disparities in central community. Coordinating community-based experiences for students nurses to enhance their ability to care for aging or vulnerable population.

EXPERIENCE:

08/‘12-present08/‘12-present Keelung Municipal Government Health Bureau senior friendly community health consultants

08/‘00-07/’15 Kang Ning Junior College of Nursing
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Director/Nursing Lecturer, Nursing Department
Full-time instructor teaching registered nursing courses, primarily medical/surgical, vocational nursing courses, and other allied health program courses as required. Supervise nursing practicum program, keep record and evaluate progress of individual students. Coordinate between service agencies and hospitals. Specialized course include: Long-term Care; Community Health Nursing; Health Promotion and Nursing Administration & Management.

03/‘93-07/‘00 Department of Health, Taipei City Government Taipei, Taiwan

Section Head, Hospital Management Section
Organized, promoted, and supervised health education projects, hospital management plans and long-term care projects. Served as a supervisor in the Health Care Reformation Committee in Taipei City Government and published “The Health Care Reformation White Paper in Long-term care (1/‘96)

02/‘91-03/‘92 Groote Schuur Hospital Western Cape, South Africa

Professional Nurse, Intensive Care Unit
Assisted open-heart operations and provided post-operative nursing care and care for patients with critical diseases. Operated AV Fistula and conducted dialysis procedures.

07/‘82-12/‘83 Hofuf General Hospital Ministry of Health, Kingdom of Saudi Arabia
Registered Nurse/Superintendent, Intensive Care Unit; Med/Surg Provided direct patient care and was in charge of nursing management and administration at the hospital.

01/‘78-03/‘93 Taipei Municipal Chung Hsing Hospital Taipei, Taiwan

Head Nurse/Nursing Superintendent, Cardiovascular Ward, ICU, Hemodialysis Center
Provided strong contributions as a key member in the medical team. Exhibited motivation by providing the highest quality of care to teach patient.

07/‘71-12/‘77 Taipei Veterans General Hospital Taipei, Taiwan

Registered Nurse, Med/Surg., Chest Med., Neurology Ward, POR, OR, ICU, CV
Provided direct patient care and maintained high degree of accuracy to achieve optimal patient acuity monitoring. Oversaw and administered patient medication/dosage and interpreted physician instructions.

EDUCATION:
08/‘11-present
Johns Hopkins University, Department Public Health Policy and Management

09/‘96-06/‘98 National Yang Ming University, Taipei, Taiwan
Master of Science in Nursing, Institute of Community Health Nursing
Thesis: *Comparison of Menopausal Attitudes and Symptoms between Taipei Urban Midlife Women and Health Professionals*.

03/‘91-03/‘92 Carinus Nursing College Cape Town, South Africa
Diploma in Intensive Nursing Science

09/‘68-07/‘71 National Taipei College of Nursing Taipei, Taiwan
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Diploma in Nursing

LICENSURES:
NCLEX RN, California, USA, File No.: 513933 (3/‘06)
College Lecturer in Nursing, Taiwan, File No.: 061376(11/‘00)
Registered Nurse Certificate, South Africa Nursing Council (4/‘92)
Registered Professional Nurse, Taiwan, File No.: 0478 (3/‘72)

HONORS AND ACTIVITIES:

- Received *Distinguished Nurse 2006* Award, The National Union of Nurses Association, R.O.C.

- Member of international honor society of nursing, *Sigma Theta Tau International* since '98
- Presented in the '04 & '06 International Conference on Health Promoting Schools
- Served as a consultant for nursing services and on-the-job training in '03-'04
- More than 6 times received Taipei City Government Certificate in Nursing Research Projects since '89
- Presented in the 16th International Nursing Research Congress in Hawaii's Big Island. Topic: *Differences in perceived menopausal symptoms among health professionals and menopausal symptoms experienced by midlife women in Taipei, Taiwan*. (7/'05)

PUBLICATIONS:

Co-author of the article: ***A Comparison of Menopausal Attitudes between Midlife Women and Health Professionals in Taipei,*** *Tzu Chi Medical Journal 2000*; 12: 267-275

Co-organizer of the research project: ***Differences in Perceived Nursing Competency Characteristics among Kang-Ning Graduate Students and Nurse Administrators*** (3/'06)

Author of the research article***: A Comparison of Attitudes and Acceptance Pertaining to HIV Positive Patients among Health Professionals after Participating "AIDS Nursing Care Seminar"***. *Journal of the Hospital Association Republic of China 1996,* No. 4: 31-43.

Co-author of the article: ***An Investigation of Unregistered Nursing Homes in Taipei City,*** *Health Administrationl Journal 1994*; *No. 4:35-46.*

Co-author of the article: ***An Investigation of Unacute Hospitalization in Taipei City Hospital Prevalence, Long Term Care Need and Attitude,*** *Nursing Research Journal 1996*; *No .2:151-159.*

Author of the Critical Care Nursing article***: Nervous System***. *2004, Wagner Co.,Ltd Chapter*. 5:1-55.

Author of the Public Health Nursing***: Community Development And Assessment of Community Health***. *2009,Wagner Co.,Ltd Chapter*. 7:1-51.

Author of the Public Health Nursing***: Environmental Health***. *2009,Farseeing Publishing. Co.,Ltd. Chapter*.14:405-538.

CONTINUING EDUCATION:

Participated in trainings/advanced nursing courses more than 20 hours per year for over 30 years. Topics include: Stress Management, Communication, Intensive Care Assessment; Renal Failure; Nursing Care for Senior Citizens; Research Writing and Publication; Ethnographic Research; Critical Thinking and Nursing Education; Research and Information Strategy; Writing and Presenting Research Papers in English; Community Development and Geriatric Care, and so on.

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